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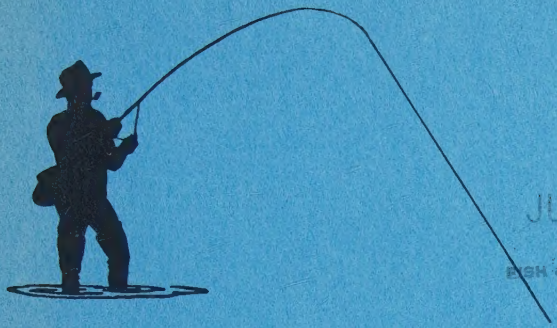

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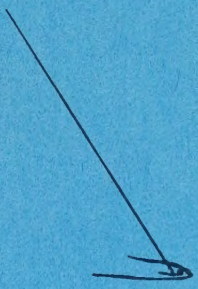
SPORT FISHERY ABSTRACTS



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Abstracts 14225-14582

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SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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14225. Walker, Charles R. (U. S. Dept. of Interior, Branch of Pest Control Research, Washington, D. C.). 1971. PROBLEMS IN CLEARANCE AND REGISTRATION OF HERBICIDES FOR AQUATIC AREAS. Hyacinth Control Journal, 9(1): 5-17.

A major crisis faces fish culture, wildlife habitat improvement, and plant species management of aquatic areas in the development, registration, and use of pesticides, drugs and other chemicals. Recent public concern for the use of drugs and pesticides and their attendant effects on public health and environmental quality is presenting the regulatory agencies with a tremendous task of carefully reviewing the registration of thousands of pesticide and drug formulations - these include chemicals used in water and fisheries. Thus, we are faced with two problems: developing chemical tools for managing and enhancing sport fisheries, wildlife, and aquatic oriented recreation, and conversely - preventing contamination of or adverse effects on either water quality, wildlife, fish, the aquatic environment and man's recreational pursuit and health. Because of the lack of intensive research on cultural and management tools, fish culturists and management biologists have tended to borrow tools and techniques from other disciplines. Obviously, many chemicals are being used in fish culture and management in a very promiscuous, if not outright illegal manner. Fortunately, these uses involve small quantities of material and are isolated geographically in most instances. Chemicals defined as food additives and drugs, according to regulations under the Federal Food, Drug, and Cosmetic Act, now must be re-examined and classified as a new drug or as an old drug. In either case, adequate safety to public health must be assured by substantial evidence of its relative toxicity, efficacious use, and disappearance of harmful residues. Persistence of potentially harmful residues require provisions in the label for conditions for use, withdrawal time, and also necessitates establishing a residue tolerance limit in a petition to the Environmental Protection Agency. Thus, in examining the more than 95 chemicals known to be used experimentally or operationally in fish culture and fishery management, we find an appalling situation with regard to specific uses and status of registration. In most instances the chemical industry has little or no profit motivation nor even a proprietary position on the majority of the chemicals. Thus, in many instances they cannot be expected to support the expensive process of obtaining the data required for registration. Further, the primary source for information on toxicity, efficacy and residues in fish and aquatic environments must be generated by State and Federal Research. However, this capability is limited or severely restricted by budget, personnel, and facilities to adequately generate the necessary data, properly assemble the information, and effectively pursue the registration process. This will require a cooperative effort of all concerned - State, Federal, and private agencies - with an agreement on the protocol for research needed.

14226. Wyatt, Ellis J., and Kirk T. Beiningen (Fish Comm. of Oregon, Hatchery Biol. Section, Clackamas, Oregon). 1971. NITROGEN GAS BUBBLE DISEASE RELATED TO A HATCHERY WATER SUPPLY FROM THE FOREBAY OF A HIGH-HEAD RE-REGULATING DAM. Research Reports of the Fish Comm. of Oregon, Vol. 3, pp. 3-12.

Studies of the water supply system at the Fish Commission of Oregon's South Santiam River Hatchery were made following the loss of nearly a half million salmonid fishes due to gas embolism. Hatchery water from the forebay of adjacent Foster Dam had become supersaturated with dissolved nitrogen as the result of air entering the supply system. Experiments revealed that fish were exposed to concentrations in excess of 150% of saturation and rapidly died from the effects of gas bubble disease. Biological assay data regarding supersaturation rates, exposure times, death rates, and gross pathology are reported. (Authors)

14227. Swartz, Don F. (Fish Comm. of Oregon, Hatchery Biol. Section, Clackamas, Oregon). 1971. THE USE OF OXYTETRACYCLINE MARKS IN VERTEBRA OF ADULT SALMON TO DETERMINE SMOLT SIZE. Research Reports of the Fish Comm. of Oregon, Vol. 3, pp. 59-60.

14228. Henry, Kenneth A. (NMFS Biol. Lab., Seattle, Washington). 1971. ESTIMATES OF MATURATION AND OCEAN MORTALITY FOR COLUMBIA RIVER HATCHERY FALL CHINOOK SALMON AND THE EFFECT OF NO OCEAN FISHING ON YIELD. Research Reports of the Fish Comm. of Oregon, Vol. 3, pp. 13-27.

Nearly 31 million fall chinook salmon, Oncorhynchus tshawytscha (Walbaum), were marked and released in 1962-65 from 12 Columbia River hatcheries. All the major fisheries that caught these fish were systematically sampled in 1964-69. The estimated fishing intensities and maturity schedules for the 1962-brood releases were calculated and wherever possible comparisons made with the 1961 brood data. A general model that was developed for the 1961 brood data, and which equates ocean catch and river entry with recruitment, mortality, and maturation rates, was utilized in this work. The calculated 6-month fishing intensity rates were higher for 1962 than 1961 brood for both general marks and Kalama Hatchery marks. Since it was not possible to make estimates for the 1962 brood Spring Creek fish, no direct comparisons for the two broods from this hatchery were attempted. Estimates of fish mortality and proportions maturing changed relatively little when large changes in natural mortality were used. Apparently only about 0.3% of all marked fish released were alive at the beginning of their third year, when most of them became available to the fisheries. Mortality rates for marked Kalama fish were used for unmarked Kalama Hatchery fish, but maturation rates were adjusted for possible delayed maturity of marked fish. The total catch of 1962-brood chinook from the Kalama Hatchery was estimated to be 134,409 kg, compared to 203,331 kg for the 1961 brood. Elimination of the estimated loss due to marking would have raised the 1962 catch to 153,045 kg. Ocean fishing apparently reduced the number of Kalama fish that returned to the Columbia River by about 70% and the weight yield of hatchery fish by 25%. This compares with a reduction of about one-half in number and 19% in weight for 1961-brood Kalama Hatchery fish. (Auth.)

14229. Bohn, Burnell R., and Howard E. Jensen (Fish Comm. of Oregon, Research Div., Clackamas, Oregon). 1971. INVESTIGATION OF SCALE PATTERNS AS A MEANS OF IDENTIFYING RACES OF SPRING CHINOOK SALMON IN THE COLUMBIA RIVER. Research Reports of the Fish Comm. of Oregon, Vol. 3, pp. 28-36.

An attempt was made to identify races of spring chinook, Oncorhynchus tshawytscha (Walbaum), from scale samples collected from adult fish in major tributaries of the Columbia River system during 1966. The following characteristics were compared: (1) number of circuli to the first annulus, (2) number of circuli to the end of fresh-water growth, and (3) mean distances between circuli. Tributary streams were grouped into four geographic areas: (1) lower Columbia River, (2) middle Columbia River, (3) upper Columbia River, and (4) Snake River. It was concluded that races could not be separated by the methods used. Although counts differed somewhat, the distinction between groups was insufficient for practical separation. Counts to the first annulus did provide a means of identifying wild and hatchery fish in the Willamette River. Examination of scales from known wild and hatchery fish indicated that an error of about 20% would result when 16 or less circuli were used to identify wild fish and 17 or more to identify hatchery stocks. (Authors)

14230. Demory, Robert L. (Fish Comm. of Oregon, Res. Div., Newport, Oregon). 1971. DEPTH DISTRIBUTION OF SOME SMALL FLATFISHES OFF THE NORTHERN OREGON-SOUTHERN WASHINGTON COAST. Research Reports of the Fish Comm. of Oregon, Vol. 3, pp. 44-48.

The depth distribution of small flatfish of six species common to the Oregon and Washington coasts is shown. Depth distribution varies with season in that small fish of most species inhabit deeper water in winter than in spring or summer. There is little separation by depth of small fish from their larger kin. Generally, small flatfish are constantly exposed to encounters with commercial trawl gear since about 95% of commercial trawl effort is expended on the continental shelf. (Auth.)

14231. Burck, Wayne A. (Fish Comm. of Oregon, Res. Div., Elgin, Oregon). 1971. GROWTH OF JUVENILE SPRING CHINOOK SALMON IN LOOKINGGLASS CREEK. Research Reports of the Fish Comm. of Oregon., Vol. 3, pp. 37-43.

I studied growth of juvenile spring chinook salmon (Oncorhynchus tshawytscha Walbaum) in Lookingglass Creek during 1964-68. Mean lengths of fish sampled increased from about 35 mm in March to over 80 mm in October. Growth was rapid and relatively uniform from April to September and averaged between 7.2 and 9.6 mm per month. Condition factor was near 0.8 in April and ranged between 1.0 and 1.1 in most samples collected from June through November. Condition factor increased with fish length. The length-weight regression equation calculated from the sample data is log W = -5.44454 + 3.25386 log L. Fish reared in separate areas of the stream showed some differences in linear growth which may be a reflection of differences in water temperature in these areas. (Auth.)

14232. Toetz, Dale W. 1971. SOME OBSERVATIONS ON THE LIMNOLOGY OF A POND RECEIVING ANIMAL WASTES. Contribution 461, Dept. of Zool., Okla. State Univ. in Proc. Okla. Acad. Sci. 51: 30-35.

Limnological observations were made on a small pond in Oklahoma which receives runoff from a swine yard. Large populations of blue-green algae were dominant during the summer and Chlorella during the winter. Heavy runoff quickly decreased the concentration of ions on two occasions and also altered the size and composition of the community of phytoplankton. The concentration of major ions fluctuated markedly. Oxygen concentrations were often low and reduced nitrogen compounds predominated. The pond is similar to other bio-oxidation ponds in Oklahoma and probably would not be suitable for fish culture. (Auth.)

14233. Muir, Barry S., and Clinton E. Brown (Fish. Res. Bd. of Canada, Marine Ecology Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1971. EFFECTS OF BLOOD PATHWAY ON THE BLOOD-PRESSURE DROP IN FISH GILLS, WITH SPECIAL REFERENCE TO TUNAS. J. Fish. Res. Bd. Canada 28(7): 947-955.

In tuna gills, blood flows obliquely to the long axis of the secondary lamellae rather than with it as in other teleosts. This pathway greatly shortens the length of the small diameter respiratory vessels; it shortens them by a factor of 4 in a 1.67-kg skipjack tuna (Euthynnus pelamis) and of 9 in a 272-kg bluefin tuna (Thunnus thynnus). Total blood-pressure drop across the entire gill varies as the square of the length of these vessels, so the drop is reduced by a factor of 16 in the skipjack and of about 80 in the bluefin tuna. Blood-pressure drop also varies as the inverse of the cube of the vessel diameter, and several teleosts we examined showed a compensating increase in diameter as length increased with fish size. Because of the shorter vessel lengths, the diameters seen in tunas are relatively small. Vessel diameter determines, considerably, the thickness of the secondary lamellae. The specialized pathway of the tunas, in addition to reducing blood pressure drop, allows the secondary lamellae to remain relatively very thin. For a given lamellar spacing, this maximizes the interlamellar water channel thickness and minimizes resistance to water flow. The specialization is a major change in "design strategy" and its advantage appears to lie with the balance between the energy requirements of moving water and blood. Some such change may be essential to the attainment of high levels of activity in fish of large size. (Authors)

14234. Mauck, Wilbur L., and Daniel W. Coble (Missouri Coop. Fish. Unit., Univ. of Mo., Columbia, Missouri). 1971. VULNERABILITY OF SOME FISHES TO NORTHERN PIKE (Esox lucius) PREDATION. J. Fish. Res. Bd. Canada 28(7): 957-969.

To compare vulnerability to predation by northern pike (Esox lucius Linnaeus), several species of fish in various combinations were held with pike in plastic swimming pools with and without cover and in small ponds. The most vulnerable species in order were gizzard shad (Dorosoma cepedianum), carp (Cyprinus carpio), bigmouth buffalo (Ictiobus cyprinellus), fathead minnow (Pimephales promelas), and smallmouth bass (Micropterus dolomieui). White sucker(Catostomus commersoni),

green sunfish (Lepomis cyanellus), largemouth bass (Micropterus salmoides), golden shiner (Notemigonus crysoleucas), and yellow perch (Perca flavescens) showed intermediate vulnerability. Channel catfish (Ictalurus punctatus), northern pike, bluegill (Lepomis macrochirus), and black bullhead (Ictalurus melas) were least vulnerable. In two experiments in which fish were put in cages in turbid water, relative vulnerability was the same as in clearer water. Pike could not be conditioned to eat golden shiner or bluegill. There was a tendency for certain sizes of pike to select the smaller carp, fathead minnow, and bluegill within the size ranges tested. (Authors)

14235. Schreck, Carl B., and Robert J. Behnke (Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, Colorado). 1971. TROUTS OF THE UPPER KERN RIVER BASIN, CALIFORNIA, WITH REFERENCE TO SYSTEMATICS AND EVOLUTION OF WESTERN NORTH AMERICAN Salmo. J. Fish. Res. Bd. Canada 28(7): 987-998.

The five endemic species and subspecies of trout named from the upper Kern River drainage of the southern Sierras are revised to two subspecies of Salmo aguabonita: S. a. aguabonita and S. a. gilberti. Analysis of various characters led us to conclude that S. a. aguabonita did not differentiate from a coastal rainbow trout as surmised by other workers. This conclusion was based on: (1) morphological similarities with the inland cutthroat trout; (2) apparent relationships with the Gila, Apache, and Mexican golden trouts of New Mexico, Arizona, and northern Mexico, respectively; (3) a chromosomal complement identical to that of the Apache trout and more readily derived from that of S. clarki than from that of S. gairdneri; and (4) geomorphogeny and zoogeography of the southern Sierras. This evidence suggests the golden trout represents an ancient form whose origin was associated with a widely distributed group of goldenlike trouts. The trout originally from the Kern River has a chromosome count and a chromosome arm number identical to those of S. a. aguabonita and therefore is classified as S. aguabonita gilberti. The Little Kern golden trout, S. whitei, is considered a synonym of S. a. gilberti. Similarities with an undescribed form of the McCloud-Pit drainage of northern California suggests a common ancestry. Today, S. a. gilberti is best represented by populations in the upper Little Kern watershed. Salmo roosevelti is considered a synonym of S. a. aguabonita, and S. rosei most likely had a hybrid origin derived from introductions of S. a. gilberti and S. a. aguabonita. (Authors)

14236. Symons, Philip E. K. (Fish. Res. Bd. of Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. SPACING AND DENSITY IN SCHOOLING THREESPINE STICKLEBACKS (Gasterosteus aculeatus) AND MUMMICHOG (Fundulus heteroclitus). J. Fish. Res. Bd. Canada 28(7): 999-1004.

Photographs of groups of threespine sticklebacks (Gasterosteus aculeatus) and mummichog (Fundulus heteroclitus) from above and from the side, and comparison of regularity of spacing at various densities with that in "schools" of dead fish arranged randomly or regularly, showed that live fish were usually spaced regularly when the average distance to nearest neighbour was less than 1 fish length. At greater distances (lower densities) spacing between fish became irregular. The lowest density at which regularity occurs could be considered the critical density separating potentially regularly spaced schools of fish from loose aggregations. (Auth.)

14237. Messieh, S. N., and S. N. Tibbo (Fish. Res. Bd. of Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. DISCRETENESS OF ATLANTIC HERRING (Clupea harengus harengus) POPULATIONS IN SPRING AND AUTUMN FISHERIES IN THE SOUTHERN GULF OF ST. LAWRENCE. J. Fish. Res. Bd. Canada 28(7): 1009-1014.

Evidence was obtained that spring and autumn herring fisheries in the southern Gulf of St. Lawrence are supported by two discrete stocks. Samples from the two fisheries taken in 1965 through 1969 differed in length- and age-frequency distributions, year-class composition, growth rate, spawning time, and mean numbers of pectoral and dorsal fin rays. (Authors)

14238. Clayton, J. W., D. N. Tretiak, and A. H. Kooyman (Fish. Res. Bd. of Canada Freshwater Inst., Winnipeg 19, Manitoba, Canada). 1971. GENETICS OF MULTIPLE MALATE DEHYDROGENASE ISOZYMES IN SKELETAL MUSCLE OF WALLEYE (Stizostedion vitreum vitreum). J. Fish. Res. Bd. Canada 28(7): 1005-1008.

Electrophoresis of extracts of white skeletal muscle revealed a total of six phenotypes of malate dehydrogenase (MDH) (L-malate; NAD oxidoreductase, EC 1.1.1.37) isozymes in walleye (Stizostedion vitreum vitreum). The individual MDH phenotypes consisted of four or more MDH isozymes. The heritability of all six phenotypes was tested in a breeding experiment. The results of the breeding experiment provided evidence for the existence of three nondominant alleles at one MDH locus. Subcellular fractionations indicated that these three alleles code for a supernatant (extramitochondrial) form of MDH. The frequencies of these alleles varied in fish from four locations in western Canada. (Authors)

14239. Bilinski, E., R. E. E. Jonas, and Y. C. Lau (Fish. Res. Bd. of Canada Vancouver Lab., Vancouver, Brit. Columbia, Canada). 1971. LYSOSOMAL TRIGLYCERIDE LIPASE FROM THE LATERAL LINE TISSUE OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada 28(7): 1015-1018.

An acid lipase active toward tripalmitin and having the characteristics of lysosomal enzymes was shown to occur in the red lateral line tissue of rainbow trout (Salmo gairdneri). The enzyme showed maximum activity at pH 4-4.5. Triton X-100 (0.2-2.0%) strongly stimulated the activity of the acid lipase, but it inhibited markedly the lipolytic activity above pH 7. NaF (20 mM) and Na-p-chloromercuriphenyl-sulfonate (1 mM) partially inhibited the acid lipase. Fractionation of the total homogenate by differential centrifugation in 0.25 M sucrose showed that the acid lipase was present at highest concentration in the light mitochondrial fraction. Palmitic acid and dipalmitin were the two main products of hydrolysis of tripalmitin. (Authors)

14240. Jenkins, Thomas M., Jr. (U.S. Bur. of Sport Fish. and Wildl., Sierra Nevada Aquatic Res. Lab., Bishop, California). 1971. ROLE OF SOCIAL BEHAVIOR IN DISPERSAL OF INTRODUCED RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada 28(7): 1019-1027.

Hatchery-reared rainbow trout (Salmo gairdneri) planted under partially controlled conditions in an observation stream failed to show social density regulation or socially induced dispersal. Aggression frequency was only an imprecise function of density, and density may not have been influenced by aggression at all. Dispersal following planting was extensive, but it apparently resulted from individual differences in response to the habitat. Group behavior (schooling) affected dispersal radically in some instances, when fish in large groups undertook movements they would not have undertaken alone or in small groups. (Auth.)

14241. Murray, D., and D. Povoledo (Fish. Res. Bd. of Canada Freshwater Inst., Winnipeg, Manitoba, Canada). 1971. DETERMINATION OF NITRILOTRIACETIC ACID IN INLAND WATERS BY GAS CHROMATOGRAPHY OF THE TRIMETHYL ESTER. J. Fish. Res. Bd. Canada 28(7): 1043-1047.

A method for the analysis of low concentrations of nitrilotriacetic acid (NTA) in natural waters was developed. The NTA was converted to the trimethyl ester and determined quantitatively by gas chromatography using methyl heptadecanoate as an internal standard. The lower limit of detection was 25 µg/liter of NTA. The identity of the ester was confirmed using a mass spectrometer-gas chromatograph combination. (Authors)

14242. Reimers, Paul E. (Fish Comm. of Oregon, Res. Div., Port Orford, Oregon). 1971. ALGAE GROWTH AS A CAUSE OF TAG LOSS FROM JUVENILE FALL CHINOOK SALMON IN SIXES RIVER ESTUARY, OREGON. Research Reports of the Fish Comm. of Oregon, Vol. 3, pp. 56-58, illus.

14243. Edmunds, Philip H., and James I. Sammons (NMFS, Narragansett Sport Fish. Marine Lab., Narragansett, Rhode Island). 1971. GENIC POLYMORPHISM OF TETRAZOLIUM OXIDASE IN BLUEFIN TUNA, Thunnus thynnus, FROM THE WESTERN NORTH ATLANTIC. J. Fish. Res. Bd. Canada 28(7): 1053-1055.

Blood and tissues from bluefin tuna (Thunnus thynnus) contain several electrophoretically distinct forms of the enzyme tetrazolium oxidase. Every fish exhibits one of three oxidase phenotypes: a single band at either of two positions on the gel or both bands with a third midway between them. The pattern comprising three bands occurs in both males and females. Frequency distributions of phenotypes conform to Hardy-Weinberg distributions and apparently are not related to fish size. We conclude from these facts that bluefin tetrazolium oxidase contains two protein subunits and that phenotypic differences among individuals reflect segregation of two codominant autosomal alleles. Frequency distributions of phenotypes in three areas of the western North Atlantic do not differ significantly. (Authors)

14244. Banerjee, Tapan (Dept. of Marine Sci., Southern Maine Vocational Tech. Inst., Fort Rd., So. Portland, Maine). 1971. MATURITY AND FECUNDITY OF THE WHITE SEAPERCH (Phanerodon furcatus) FROM TOMALES BAY, CALIFORNIA. J. Fish. Res. Bd. Canada 28(7): 1051-1053.

The embryonic development of Phanerodon furcatus was found to be very similar to that of other members of the Embiotocidae; the smallest embryo (16.2 mm) had developed scales on the body and pigments in the eye. The embryos at birth measure approximately 43.5 mm. The average number of embryos for all females during the study was 19.6, and the embryos varied from 8 in a female measuring 196 mm to 33 in one measuring 262 mm in fork length. The number of embryos generally increases with an increase in size of the female parent. The breeding season of white seaperch, Phanerodon furcatus, in Tomales Bay, California, starts from the early part of May and extends to the middle of August. (Auth.)

14245. Marcy, Barton C., Jr. (Essex Marine Lab., Essex, Connecticut). 1971. SURVIVAL OF YOUNG FISH IN THE DISCHARGE CANAL OF A NUCLEAR POWER PLANT. J. Fish. Res. Bd. Canada 28(7): 1057-1060.

No young fish of nine species entrained in the condenser cooling-water system of a nuclear power plant survived passage to the lower end of the plant's 1.83-km (1.14-mile) discharge canal when water temperatures were above 30 C. Temperatures in the canal remained above 30 C during 95% of the period during which the fish larvae and juveniles were collected near the plant's intake. A field observation device was developed to keep alive for counting those larvae and juvenile fish that survived passage to sampling points in the system. (Auth.)

14246. Frantsi, C., and M. Savan (Dept. of Vet. Microbiol. and Immunology, Univ. of Guelph, Guelph, Ontario, Canada). 1971. INFECTIOUS PANCREATIC NECROSIS VIRUS: COMPARATIVE FREQUENCIES OF ISOLATION FROM FECES AND ORGANS OF BROOK TROUT (Salvelinus fontinalis). J. Fish. Res. Bd. Canada 28(7): 1064-1065.

When isolation of infectious pancreatic necrosis (IPN) virus was attempted simultaneously from feces and organs of brook trout (Salvelinus fontinalis), the virus was isolated more frequently from organs than from feces. However, the greater the degree of stress on the fish, the closer the number of isolations from feces appeared to approach that from organs, and the virus was isolated from both organs and feces of each of 10 fish accidentally exposed to low oxygen concentration for 4 days. The findings suggest that masked viral and bacterial infections may be detectable if fish are placed under stress. (Authors)

14247. Cummings, T. Edwin (Fish Commission of Oregon, Tillamook, Oregon). 1971. A NOTE ON COASTAL MOVEMENT OF SHAD. Research Reports of the Fish Comm. of Oregon, Vol. 3, p. 60.

14248. Colby, Peter J. 1971. ALEWIFE DIEOFFS: WHY DO THEY OCCUR? Contrib. 436, U. S. Fish & Wildl. Serv., Great Lakes Fish. Lab., Ann Arbor, Mich., Reprint from Limnos, 4(2): 18-27.

That alewives are severely stressed by low temperatures (less than 3° C) in the laboratory, is indicated by their marked behavioral responses, susceptibility to fungal infection, and mortalities; in contrast, certain endemic species are not noticeably affected. Field observations support laboratory evidence that alewives are stressed by low temperatures. Hydrographic and meteorological data indicate that the period from mid-March to mid-April should be the time of low-temperature stress for alewives; mortalities can be expected to depend on the severity of the winter and consequently the degree of stress. Winter alewife mortalities in the Great Lakes Region have usually been reported during periods when water temperatures were within the range that was fatal to alewives under laboratory conditions. The mortalities of alewives in summer (June, July, and sometimes August) are associated with physiological changes (e.g., in electrolyte balance, or in certain endocrine functions), the significance of which is still open to speculation. Although it has been demonstrated that physiological changes occur in alewives during times of stress or when stress is suspected, the studies to date have not been definitive. To date, too little information is available to permit a definitive appraisal of the cause of the massive alewife mortalities in the Great Lakes; however, the scattered data may be sufficient to allow the formation of the following testable hypothesis as to the cause of the periodic mass mortalities: Since the alewife is an anadromous fish which evolved in the ocean, where food was less limiting and temperature extremes were less severe than in the Great Lakes, mass mortality in fresh water may be caused by physiological changes (e.g., electrolyte imbalance, exhaustion of some endocrine function), weaknesses, or requirements operating in association with a potentially lethal factor (low temperature). Once landlocked the alewife may also greatly reduce its food supply; the resulting loss of condition further reduces its capacity to withstand the extremes and fluctuations in temperature characteristic of the Great Lakes. (From auth. conclusions)

14249. Parrott, Arthur W. (The Cawthron Inst. Museum, Nelson, New Zealand). 1971. THE AGE AND RATE OF GROWTH OF QUINNAT SALMON [Oncorhynchus tshawytscha (Walbaum)] IN NEW ZEALAND. New Zealand Mar. Dept., Fish. Tech. Report No. 63, 66 p.

Unpublished notes on the introduction, distribution and life-history of quinnat in New Zealand waters are included together with observations on the growth of parr and smolt scales in relation to the procedure of determining the age and rate of growth of the fish from their scales. Finally age and growth analysis of samples taken during the quinnat runs in the Waimakariri, Rangitata and Hakataramea Rivers between 1927 and 1931. Emphasis is laid on the importance of recognising the relative abundance of stream and ocean type fish and age groups (year-classes) when comparing quinnat from different rivers or from season to season in the same river system. The data presented should form a basis on which future work on the age and growth of quinnat in New Zealand may be compared, so that changes may be traced in the age and growth patterns of the quinnat stocks in our rivers, thus forming a basis for the conservation and development of the fishery. (Auth. summ.)

14250. Henson, E. B., and Milton Potash (Vermont Univ., Dept. of Zool., Burlington, Vermont). 1970. LIMNOLOGY OF LAKE CHAMPLAIN: 1965-1970. Vermont Water Resources Research Inst. Completion Report, Dec. 1970, 23 p; Selected Water Resources Abstracts 4(17): p. 8.

This five year study assembled information on physical, chemical, and biological characteristics of Lake Champlain, Vermont, one of the largest and deepest lakes of the USA. The determinations included currents of the lake, water thermal and optical features, alkalinity, pH value, selected cations, dissolved oxygen, nitrates, phosphates, mercury, lead, phytoplankton, zooplankton, micro- and macro-benthos, colonization of shorelines, Polychaeta worms, and seston content.

14251. Hall, Charles A. S. (Dept. of Zool., No. Carolina Univ., Chapel Hill, North Carolina). 1971. MIGRATION AND METABOLISM IN A STREAM ECOSYSTEM. Report No. 49, WRRI, The Univ. of No. Carolina, Feb. 1971, 243 p., 52 fig., 33 tab., 120 ref.; Selected Water Resources Abstracts 4(17): p. 23.

Fish migration and total stream metabolism were monitored in New Hope Creek, N. C., from April 1968 to June, 1970. Most of the 27 species had a consistent pattern of larger fish moving upstream and smaller fish moving downstream. In the spring of 1969, a daily average of 7 fish weighing a total of 1081 grams were caught moving upstream, and 17 fish, weighing a total of 472 grams, were caught moving downstream. The larger average size of the fish moving upstream resulted in a large transfer of fish mass upstream. Diurnal oxygen series were run to measure the metabolism of the aquatic community. Gross photosynthesis ranged from 0.21 to almost 9 g m-2 day - 1 (g/m2/day), and community respiration from 0.4 to 13 g m-2 day-1 at the principal sampling station and both were highest in the spring. Area values of metabolism were similar for different parts of the stream, but both production per volume and respiration per volume were much larger near the headwaters than farther downstream. Migration may allow populations to take advantage of such differences in productivity by maintaining young fish in areas of high productivity. An energy diagram was drawn comparing energies of insolation, currents, photosynthesis, respiration, fish populations, and migrations. Parts of this model were simulated on an analog computer. Input energies from insolation and stream flow were similar. About 0.14 percent of the total respiration of the stream was from fish populations, and over one year about 0.01 percent of the total energy was used for the process of migration. The migration energy has an amplifying value of 14. Recommendations were included concerning sampling for dissolved oxygen and other aspects of water quality management.

14252. McCormick, J. Howard, and Roll F. Syrett (Nat'l. Water Qual. Bab., Fed. Water Qual. Admn., Duluth, Minnesota). 1970. A MODULAR CONTROLLED-TEMPERATURE APPARATUS FOR FISH EGG INCUBATION AND FRY REARING. National Water Qual. Lab., mimeographed report, Nov.1970, 18 p.; Selected Water Resources Abstracts 4(17): p. 24.

An apparatus is described for aquatic bioassay studies. The apparatus described is constructed on a modular basis and provides continuous flow of water at constant temperatures for experimental work with fish eggs and fry. Each module provides one test temperature, which is controlled with a thermoregulator and immersion heater in each headbox. Flow is regulated by headbox elevation and orifice size.

14253. Speece, R. E., and W. E. Leyendecker (New Mexico State Univ., University Park, New Mexico). 1969. FISH TOLERANCE TO DISSOLVED NITROGEN. Engr. Experiment Sta., New Mexico State Univ. Tech. Report No. 59, Nov. 1969, 43 p.; Selected Water Resources Abstracts 4(17): p. 30.

The tolerance to dissolved nitrogen of trout fingerlings and goldfish was compared in both pressurized and non-pressurized systems. The effect of the dissolved nitrogen on the rate of respiration of the fingerlings was also determined. Dissolved nitrogen concentrations as low as 100% of saturation caused trout fingerlings mortality in the pressure system. This phenomenon was interesting since many well-aerated trout streams have 100% saturation concentrations of dissolved nitrogen. However, large numbers of bubbles were found on the specimens and the walls of the holding troughs, and it was speculated that these bubbles were quite possibly the cause of the mortality. Both goldfish and trout lost equilibrium in the pressure system, but the goldfish floated and survived while trout died. Trout fingerlings were unable to tolerate 105% of dissolved nitrogen saturation for more than 4-1/2 days, while goldfish survived saturation 5 days. Goldfish in non-pressure systems were unaffected by saturations as high as 140% for 48 hours but in pressure systems, they lost equilibrium at 100% of dissolved nitrogen saturation in less than an hour.

14254. Barnes, C. A. (Colo. State Dept. of Natural Resources, Div. of Game, Fish and Parks, Fort Collins, Colorado). 1970. COLORADO TROUT LAKE STUDIES (NEW STUDIES ON EXPERIMENTAL CONTAMINATION OF MARINE SPECIES BY CS-137, RU-106, AND CE-144). Report TID-25342, Jan. 20, 1970, 12 p.; Selected Water Resources Abstracts 4(17): p. 32.

It is concluded that in the event of renewed contamination of the environment by radioactive fallout, the larger fish from montane and alpine lakes would present the greatest potential health hazard if caught and consumed by fisherman. Results of measurements of Cs-137 contamination of fish caught in three lakes are given.

14255. Bridges, David Wilder (Dept. of Zool., N. C. State Univ., Raleigh, North Carolina). 1971. THE CRITICAL THERMAL MAXIMUM OF JUVENILE SPOT, Leiostomus xanthurus, Lacepede. Report No. 43, UNC-WRRI, N. C. State Univ. at Raleigh, Publication No. 17, Pamlico Marine Lab., Jan. 1971, 39 p.; Selected Water Resources Abstracts 4(17): p. 39.

The Critical Thermal Maximum (CTM) of juvenile spot was determined throughout their first growing season from the time they entered the oligohaline environment until they left it. Spot were acclimated in the laboratory to combinations of temperature and salinity levels prior to the CTM tests. When the data were analyzed by multiple regression, acclimation temperature, acclimation salinity, weight, weight squared, and length were all found to be significantly important influences on the CTM of juvenile spot. Temperature was the most important influence on CTM with an R2 value of 0.92. Salinity was the least important with an R2 of 0.001, and weight, weight squared and length were all intermediate influences with R2 values of about 0.18. Response surfaces were generated from the prediction equation showing the acclimation temperature necessary to produce a fixed CTM for juvenile spot. These reveal that CTM increases with size (either length or weight) and age during the nursery period. The increase in CTM was somewhat greater between summer and fall sized spot than between spring and summer sized spot.

14256. D'Itri, Frank M., Charles S. Annett, and Arlo W. Fast (Inst. of Water Research and Dept. of Fish. and Wildl., Mich. State Univ., East Lansing, Michigan). 1971. COMPARISON OF MERCURY LEVELS IN AN OLIGOTROPHIC AND A EUTROPHIC LAKE. Marine Technology Society Journal, 5(6): 10-14.

Mercury analyses established that 59 rainbow trout taken from oligotrophic Section Four Lake contained an average total mercury concentration of 0.17 ppm with a standard deviation of $\pm$ 0.10 ppm and a 99% confidence interval of 0.14 to 0.20 ppm. On the other hand, 100 rainbow trout taken from eutrophic Hemlock Lake had an average total mercury concentration of 0.07 ppm with a standard deviation of 0.05 ppm and a 99% confidence interval of 0.06 to 0.08 ppm. The total mercury content of the soils in the vicinity of the lakes is similar. However, the sediments of Hemlock Lake contained significantly higher levels of mercury than the sediments of Section Four Lake. Water samples taken from both lakes at various depths showed mercury levels of less than 0.1 ppb, the limit of sensitivity for the analytical method that was used. The removal of mercury by adsorption onto organic particulate matter probably is a key factor in the different mercury levels of fish in the two lakes. It is this adsorption mechanism that makes the mercury from pollution less available for accumulation by the fish that feed in the water column. Therefore, the persistence of mercury compounds in these two isolated lakes appears to be related to the organic character of each lake. Accordingly, mercury pollution appears to pose a greater environmental hazard in oligotrophic than in eutrophic lakes.

14257. Moose, Paul H., Richard E. Thorne, and Martin O. Nelson (Marine Acoustics, Applied Physics Lab., Univ. of Washington, Seattle, Washington). 1971. HYDROACOUSTIC TECHNIQUES FOR FISHERY RESOURCE ASSESSMENT. Marine Technology Society Journal 5(6): 35-37.

14258. Stone, Richard B. (U.S. Dept. of Comm., NOAA, NMFS, Sandy Hook Sport Fish. Mar. Lab., Highlands, New Jersey). 1971. RECENT DEVELOPMENTS IN ARTIFICIAL REEF TECHNOLOGY. Marine Technology Society Journal, 5(6): 33-34.

In 1966 biologists at Sandy Hook Sport Fisheries Marine Laboratory designed a research program to study fish habitat improvement in the marine environment through beneficial use of selected, non-toxic, solid wastes as artificial reefs. Test materials included scrap metal, mostly in the form of junk car bodies, concrete culvert, scrap tires, and obsolete ship hulls. Although all these materials became encrusted with invertebrates and attracted fish, most were difficult to handle or expensive to obtain. Tires are one material that was found readily available, inexpensive to assemble into units and easy to handle. After trying various arrangements, we decided to use two units which incorporated low assembly cost and ease of handling. One unit is simply a single tire with a concrete weight pushed inside the tire. One or two air holes are drilled or punched in the top of the tire to allow air to escape as the unit sinks. The other unit is a column of six to eight tires. The base tire is filled with concrete and two 4-1/2-foot lengths of 3/8-inch reinforcing rod are inserted in holes drilled through the sidewalls on opposite sides of the tire. The rods are bent over at the top and bottom of the column to keep the tires in place. The completed unit can be turned on its side and rolled by one man, eliminating the need for heavy equipment. There are more than 100 artificial reefs on the east coast of the United States. The construction of artificial reefs is one way sportsmen can participate in both improving the marine sport fishery and conserving our game fish resources.

14259. Backiel, Tadeusz (Inland Fish. Inst., Zabieniec, Poland). 1971. PRODUCTION AND FOOD CONSUMPTION OF PREDATORY FISH IN THE VISTULA RIVER. J. Fish Biol. 3(4): 369-405.

Vital statistics for six predatory fish species occurring in the Vistula River were estimated. The mixed, six species population, in its predatory phase, had an average biomass of 0.96 g/m^2 and produced 0.43 g/m^2. Less than 45% of annual production was exploited by man and eggs shed amounted to about 10% of the production. Annual consumption by the population amounted to about 3.44 kcal or g/m^2. Accuracy of all estimates is low. (Auth.)

14260. Goldspink, C. R., and J. W. Banks (The Limnological Inst., Nieuwersluis, The Netherlands). 1971. A READILY RECOGNIZABLE TAG FOR MARKING BREAM Abramis brama (L.). J. Fish Biol. 3(4): 407-411.

This paper describes the use of chicken wing tags as a rapid method of marking bream, Abramis brama. Experiments on captive fish suggest that mortality due to the tags is minimal, although the results of co-variance analysis show that the tags effect the condition of the fish. An analysis of the recapture data is given. (Authors)

14261. Minaur, J. (Freshwater Fish. Lab., Faskally, Pitlochry, Perthshire, Scotland). 1971. A SIMPLE ELECTRICALLY-OPERATED FEEDER FOR USE IN SALMON REARING. J. Fish Biol. 3(4): 413-415.

The construction of a simple, automatic feeder designed to dispense dry food used in salmon rearing is described. The feeder is powered by a 12 V battery and controlled by two electric clocks. Frequency of feeding, the daily duration of the feeding period, and the quantity of food dispensed can be adjusted. (Auth.)

14262. Bootsma, R. (Vet. Fac. Dept. of Diseases in Special Animals, Univ. of Utrecht, Biltstraat 172, Utrecht, The Netherlands). 1971. HYDROCEPHALUS AND RED-DISEASE IN PIKE FRY Esox lucius L. J. Fish Biol. 3(4): 417-419.

Two diseases of pike fry have been investigated, both causing serious losses in Dutch pike culture. In one of these diseases the lump developing on the head of the fry was associated with an internal hydrocephalus. The other one, 'red disease' after the haemorrhagic areas in the trunk, may be identical with red-sore disease of pike. The etiologies of both diseases are unknown. (Auth.)

14263. Bucke, David (Dept. of Pathology, Huntingdon Research Centre, Huntingdon, England). 1971. THE ANATOMY AND HISTOLOGY OF THE ALIMENTARY TRACT OF THE CARNIVOROUS FISH THE PIKE Esox lucius L. J. Fish Biol. 3(4): 421-431.

The alimentary tract of the pike is described, relating its feeding habits to its intestinal gut histology. It is a carnivorous species having a short oesophagus, pouch-like stomach and a short intestine with two convolutions. Stratified epithelium with columnar cells and many goblet cells are present in the oesophagus, columnar epithelial cells only in the stomach, and both cell types in the intestine. Eosinophils in the mucosa of the oesophagus originate from connective tissue cells and lymphocytes and neutrophils are present. The lamina propria is composed of a stratum granulosum, stratum compactum, blood vessels and loose areolar tissue. The stratum compactum is a strengthening substance, composed of collagen, characteristic of carnivorous teleosts. The circular and longitudinal muscle layers and serosa are similar to those of other carnivorous teleosts. The pancreas and liver are briefly described, the pancreas being the unusual compact type not often found in teleosts. The β cells are seen in the periphery and α cells in the centre of the islets. The liver is a unilobular organ, having oil storage as a major function. The distribution of goblet cell mucin is given, differentiating it into neutral and acid mucosubstances. Nine levels of alimentary tract were examined in the mucin distribution study. The functions of mucin in the pike are digestion, absorption, protection and lubrication. (Auth.)

14264. Edwards, D. J. (Marine Sci. Labs., Menai Bridge, Anglesey, Wales). 1971. EFFECT OF TEMPERATURE ON RATE OF PASSAGE OF FOOD THROUGH THE ALIMENTARY CANAL OF THE PLAICE Pleuronectes platessa L. J. Fish Biol. 3(4): 433-439.

The relation between temperature and rate of passage of pieces of Arenicola marina through the gut of Pleuronectes platessa was investigated by an X-ray method, using barium sulphate as a contrast medium. Time in hours taken for stomach evacuation and travel of gut contents to the rectum plotted against temperature gave negative exponential curves. Plotted logarithmically the relationships were linear. (Auth.)

14265. Narasimhan, P. V., and Bangalore I. Sundararaj (Dept. of Zool., Univ. of Delhi, Delhi-7, India). 1971. EFFECTS OF STRESS ON CARBOHYDRATE METABOLISM IN THE TELEOST Notopterus notopterus (Pallas). J. Fish Biol. 3(4): 441-451.

The effects of different types of stress on carbohydrate metabolism in N. notopterus were investigated. Starvation alone brings about a significant increase in the glycogen content of the saccus vasculosus and a significant decrease in the brain glycogen concentration. The increased glycogen concentration in the saccus vasculosus may be a device to safeguard the brain against glucose deficiency during starvation stress. Rapid depletion of the muscle glycogen following fasting shows that the muscle glycogen is the readily utilizable source of energy during starvation. Exposure of N. notopterus to air brought about an increase in the liver glycogen and blood glucose levels but did not affect other parameters studied. Physical exhaustion of N. notopterus is noticed within 1-2 min of exercise. The readily available source of energy for exercise is the muscle glycogen, and the lactic acid produced is probably metabolized in the muscle itself. Saccus vasculosus glycogen, though independent of changes in the blood glucose levels, may possibly be controlled by variations in the brain glycogen. (Authors)

14266. Glydenholm, A. O., and J. J. Scheel (Inst. of Genetics, Univ. of Aarhus, Denmark). 1971. CHROMOSOME NUMBERS OF FISHES. I. J. Fish Biol. 3(4): 479-486.

The published chromosome numbers for 208 temperate and tropical freshwater fishes have been compiled in alphabetical order within the families. This facilitates the work for ichthyologists interested in the karyotype(s) of a particular species, genus or family as well as giving an overall acount of the basic chromosome numbers and karyological trends in fishes. (Authors)

14267. Finn, J. Peter, and N. O. Nielson (Dept. of Pathology, Western Coll. of Vet. Medicine, Saskatoon, Canada). 1971. THE INFLAMMATORY RESPONSE OF RAINBOW TROUT. J. Fish Biol. 3(4): 463-478.

The basic responses of piscine tissues to inflammatory agents were investigated, using light microscopy. Tissue sections, smears and blood smears were examined. The period studied was from 3 h to 16 days after initial injury at 15°C. The piscine inflammatory response was compared to that of mammals, especially that of mice. The responses examined were basically similar to those of mammals. They varied by being less intense and slower to appear and resolve. (Authors)

14268. Houde, Edward D. (Univ. of Miami, Rosenstiel School of Mar. and Atmospheric Sci., Miami, Florida). 1971. DEVELOPMENTAL ABNORMALITIES OF THE FLATFISH Achirus lineatus REARED IN THE LABORATORY. U. S. Dept. of Comm., NOAA, Fishery Bull. 69(3): 537-544, illus.

Of 31 Achirus lineatus juveniles reared in a single experiment, 26 were abnormal. Abnormalities included incomplete eye migration, hooked dorsal fins, the presence of a left pectoral fin, ambicoloration, and partial albinism. The abnormal specimens have been described and photographed. A single reversed specimen, preserved as a nearly metamorphosed individual, also is described. Most of the abnormal conditions were interrelated. Possible effects of the rearing tank environment on abnormal development are discussed. (Auth.)

14269. Yoshima, Howard O. (NMFS, Hawaii Area Fish. Res. Center, Honolulu, Hawaii). 1971. THE EARLY LIFE HISTORY OF SKIPJACK TUNA, Katsuwonus pelamis, IN THE PACIFIC OCEAN. U. S. Dept. of Comm., NOAA, Fishery Bull. 69(3): 545-554.

This study investigates the early life history of skipjack tuna, including the distribution, abundance, age and growth. The study is based on 1,742 juvenile skipjack tuna that were found in the stomachs of 6,867 billfishes caught in Hawaiian waters and in the South Pacific by commercial longline boats. The smallest juvenile taken near Hawaii was 5.9 cm in standard length, and in the South Pacific 1.6 cm in standard length. Regressions describing the relations between the standard length and lengths of (1) the vertebral column, (2) the precaudal vertebrae, (3) caudal vertebrae, (4) the 1st-10th vertebrae, and (5) the 21st-30th vertebrae of juvenile skipjack tuna were determined. The regressions provided estimates of the standard length of fragmentary specimens. Juvenile skipjack tuna were widely distributed between lat 5° and 32° S, and long 137° W and the 180th meridian. North of the equator, the commercial longline boats fished close to the main Hawaiian Islands, and thus only a limited picture was obtained of the areal distribution of juvenile skipjack tuna. Juvenile skipjack tuna were found in almost all months in Hawaiian waters. They were most numerous in July and August. In the South Pacific, juveniles were also found in almost all months between lat 5° and 20° S. Peaks in the apparent abundance were evident in April and October in the area north of lat 10° S. Juvenile skipjack tuna appeared to be more numerous in the South Pacific than around Hawaii. Length-frequency distributions of juvenile skipjack tuna from Hawaii showed well-defined modes, which progressed with time. The growth of the juveniles was estimated by using the modal lengths determined from the monthly length-frequency distributions. Skipjack tuna between 9 and 40 cm around Hawaii are estimated to grow 2.0 cm per month. One-year-old fish are estimated to be 31 cm in standard length. (Auth.)

14270. Novotny, Anthony J., and Conrad V. W. Mahnken (NMFS Biol. Lab., Seattle, Washington). 1971. PREDATION ON JUVENILE PACIFIC SALMON BY A MARINE ISOPOD Rocinela belliceps pugettensis (CRUSTACEA, ISOPODA). U. S. Dept. of Comm., NOAA, Fishery Bull. 69(3): 699-701.

Observations were made of predation by a marine isopod on both captive and wild Pacific salmon. Under the confined conditions of pen rearing, the fry and juveniles of Pacific salmon should be included as possible prey of R. belliceps pugettensis and probably R. belliceps belliceps.

14271. Bailey, Jack E., and Dale R. Evans (NMFS Biol. Lab., Auke Bay, Alaska). 1971. THE LOW-TEMPERATURE THRESHOLD FOR PINK SALMON EGGS IN RELATION TO A PROPOSED HYDROELECTRIC INSTALLATION. U. S. Dept. of Comm., NOAA, Fishery Bull. 69(3): 587-593.

A proposed hydroelectric installation in southeastern Alaska would alter the seasonal pattern of stream temperatures and pose a threat to the natural production of pink salmon, Oncorhynchus gorbuscha. Analysis of experiments reported in the literature indicated that such an installation might lower stream temperatures below the threshold normal for the embryonic development of pink salmon. Our experiments with pink salmon eggs incubated in refrigerated water showed that the eggs required initial temperatures above 4.5°C for normal embryonic development. An increase in mortalities and in alevins with spinal deformities occurred when initial incubation temperatures were 4.5°C and lower; initial incubation at 2°C resulted in complete mortality. The proposed hydroelectric installation could result in temperatures as low as 4.5°C during spawning and initial incubation and could therefore be expected to cause an increase in mortality and the occurrence of deformed alevins. The low temperature would be followed by higher than normal winter incubation temperatures, which would have an unknown effect on the time of emergence of fry. A tunnel intake designed to draw water of a desirable temperature on demand would be required to protect salmon. (Authors)

14272. Lillelund, Kurt, and Reuben Lasker (Institut für Hydrobiologie und Fischereiwissenschaft der Universitat Hamburg, 2 Hamburg 50, Olbersweg 24, Germany). 1971. LABORATORY STUDIES OF PREDATION BY MARINE COPEPODS ON FISH LARVAE. U. S. Dept. of Comm., NOAA, Fishery Bull. 69(3): 655-667.

A variety of marine copepods have been shown to fatally injure or capture and ingest young anchovy larvae in the laboratory. Labidocera jollae, L. trispinosa, and Pontellopsis occidentalis (family Pontellidae), species common to surface waters of the California Current, are effective predators of larval fish. The copepods can be attracted by the vibrations of the larval tail beat and react by biting or capturing the fish larvae. Cruising speeds for these copepods varies from 1.5 to 4 body lengths per second which, coupled with continuous swimming behavior, results in extensive searching by the copepod for prey. In laboratory experiments, when the ratio of larval fish prey to L. jollae female individuals was low (10:1 in 3500 ml), all of the larvae were killed in 24 hr where "killing" refers to both capture-ingestion and biting resulting in a fatality. If the ratio was higher, killing increased but rarely reached 100% mortality of the larvae. L. trispinosa males and females never killed all the larvae offered to them in 24 hr in 3500 ml although more larvae were killed as the number offered was increased. Increased swimming and escape ability developed as anchovy larvae became older and were not caught or bitten as effectively as younger ones by copepods. However, killing of larvae by P. occidentalis was unaffected by the age of the larvae up to 3.5 days old. When Artemia salina nauplii were substituted for larval fish as prey for L. trispinosa, the amount of grazing was proportional to the ratio of nauplii to copepods. If the number of Artemia nauplii was less than 11-14/liter per copepod in 3500 ml all the nauplii were killed in 24 hr. When the density of nauplii was increased, more were killed but never all of them. In experiments where nauplii and yolk-sac larvae were offered together as prey the mortality of the larvae due to predation declined in proportion to the increase in the number of nauplii provided. Caloric requirements were calculated from oxygen consumption measurements and showed that only 1 to 4 anchovy larvae are required per day per copepod to satisfy the metabolic needs of Labidocera, depending on the species and the sex. This number is far less than can be killed or captured if the density of larvae is high enough. In large (140 cm) vertical cylinders larvae and L. trispinosa were distributed within 25 cm of the surface in the dark. Data are presented which show that L. trispinosa and anchovy larvae can co-occur in the upper few meters under the surface of the sea. This is probably also true for P. occidentalis and L. jollae. No data are yet available on the relative density of predatory copepods and fish larvae where they co-occur or their possible predator-prey interactions in the sea. (Authors)

14273. FAO of the United Nations (Rome, Italy). 1971. FAO AQUACULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF AQUACULTURE RESEARCH AND DEVELOPMENT. FAO Aquacult. Bull., 3(4): 24 p., illus.

Text includes: From research institutions... Induced breeding of Indian carps - Induced spawning of eels - Artificial propagation of 'manguari' - Induced breeding of shrimps and prawns - Rearing of grey mullet larvae - Hydribization of Indian carps - Feeds for tilapia and catfish - Cobalt in carp feed - Feeds for shrimps and prawns - Fish mortality caused by hydrogen sulphide - Marine farm enclosures - Species selection for marine aquaculture - Increasing yields through periodic cropping - Pond culture of Clarias - Pond culture of shrimps - Crayfish culture - Lobster culture - Mussel culture. Aquaculture development... Australia - Czechoslovakia - Fiji - Federal Republic of Germany - India - Japan - Madagascar - New Zealand - Poland - French Polynesia - The Sudan - United States - U.S.S.R. Fish diseases and their control... Health control service in Sweden - Diseases of cultured salmon - External blisters in Clarias - Fungi parasitic on shrimp. Fish introductions... Recent introductions - Transportation of channel catfish to Yugoslavia - Acclimatization of Coregonus and Chinese carps in Poland - Introduction of a new strain of rainbow trout in Argentina - Fish introductions in Mauritius. (From contents)

14274. Pora, E. A., and O. Precup (Chaire de Physiologie Animale de l'Universite de Cluj-Roumanie; Cluj, Roumania). 1971. CONTRIBUTION TO THE STUDY OF AZOTIC EXCRETION IN FISH VIII. ACTION OF CORTICOID HORMONES AND OF ACTH. (Contribution a l'etude de l'excretion azotee chez les poissons. VIII. Action des hormones corticoides et de l'ACTH). Marine Biology, 11(1): 77-81.

The action of desoxycorticosterone-acetate (DOCA), hydrocortisone (cortisol) and adrenocorticotrophic hormone (ACTH), upon the nitrogen and water-electrolyte excretion in some fishes (Gobius cephalarges, G. melanostomum and Trachurus mediterraneus) from the Black Sea was followed. In G. cephalarges and T. mediterraneus DOCA (at doses ranging from 1 to 10 mg/100 g body weight) lowered the urinary flow, inducing a water retention in the organism and a diminution of chloride elimination by the renal route. Simultaneously, DOCA induced a decrease of the total nitrogen excretion. The urinary azote concentration as well as the elimination of urea nitrogen by the renal route and the ammonia nitrogen elimination through the gills increased. Hydrocortisone, in doses of 1 to 21 mg/100 g body weight, increased the elimination of total nitrogen and caused water retention in the organism. Parallel to this, elimination of ammonia nitrogen decreased. ACTH (at a dosage of 1 to 4 IU/100 g body weight) had a stimulatory effect upon glucocorticoid activity, increasing the total nitrogen elimination, lowering the elimination of ammonia nitrogen, and inducing water retention in the organism. (Authors)

14275. Burton, Dennis Thorpe (Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. TEMPERATURE EFFECTS ON THE ANAEROBIC RESPONSES OF THREE ECOLOGICALLY DISTINCT FRESHWATER FISHES DURING GRADUAL HYPOXIA. Reprint from: Dissertation Abstracts International, 31(11): p. 6849.

The anaerobic responses to gradually induced environmental hypoxia were studied in rainbow trout, bluegills, and brown bullheads acclimated to two temperatures. Rainbow trout were tested at a warm water temperature of 15°C and a cold water temperature of 5°C. Bluegills and bullheads were tested at a warm and cold water temperature of 20°C and 5°C, respectively. A fourth species, brown trout acclimated to warm (15°C) and cold (5°C) water temperatures, was subjected to sudden hypoxia. During gradual hypoxia the metabolic response (i.e., an increase in lactic acid production) of warm acclimated fish is a gradual shift from aerobic to anaerobic metabolism at a low "threshold" oxygen tension. This shift to anaerobic metabolism occurs in both skeletal muscle and liver of a given species at approximately the same ambient oxygen tension. The environmental oxygen tension at which warm acclimated rainbow trout, bluegills, and brown bullheads shift from aerobic to anaerobic metabolism is approximately 80-90 mm Hg, 30-40 mm Hg, and 20 mm Hg, respectively. This anaerobic response is also

evident in skeletal muscle and liver of cold acclimated rainbow trout and probably bluegill sunfish. Although statistically significant increases in the lactic acid/pyruvic acid ratios of muscle and liver in bluegills did not occur, the data indicate that there is a tendency for cold acclimated bluegills to shift from aerobic to anaerobic metabolism at very low oxygen tensions. Cold acclimated bullheads did not shift to anaerobic metabolism under the conditions of this study, even when they were held for 20 minutes in water with an oxygen tension near zero. Cold acclimated trout shift from aerobic to anaerobic metabolism when the ambient oxygen tension drops to approximately 40-50 mm Hg. Bluegills shift at approximately 10-15 mm Hg. No free short-chain fatty acids were found in warm or cold acclimated rainbow trout, brown trout, bluegills, or brown bullheads. The relative magnitude of the anaerobic response (as determined by the lactic acid/pyruvic acid ratio) was greater in all warm acclimated species than in cold acclimated species. Thermal acclimation plays an important role in the anaerobic responses of fish to gradual hypoxia. Bullheads appear to have several possible adaptations which provide them with a means of withstanding severe gradual hypoxia. Trout are able to tolerate only small, transient decreases in ambient oxygen tensions rather than severe gradual hypoxia. Bluegills are intermediate in their anaerobic responses and tolerance to gradual reductions in environmental oxygen tensions.

14276. Morgan, Eric L., Dennis T. Burton, and John Cairns, Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. A TIME UNTIL DEATH STUDY OF BLUEGILL SUNFISH (Lepomis macrochirus Raf.) EXPOSED TO SIMULTANEOUS THERMAL AND ZINC STRESS. Reprint from: The ASB Bulletin, 18(2): p. 47.

This study was initiated to gain base line information on the response of the bluegill sunfish exposed simultaneously to two forms of pollutional stress: (1) zinc and (2) heat. Bluegills were exposed to five temperature regimes at 5.6 and 10.0 ppm Zn^{++} (calculated as Zn^{++} from $ZnSO_4 \cdot 7H_2O$). Both concentrations of zinc were tested on 10 fish which had been acclimated to 20°C, and 30°C, and fish which were acclimated to 20°C but were exposed to a maximum temperature of 30°C increased at the following rates: 1°C/24 hr., 1°C/1 hr., and 1.5°C/10 min. Time until death observations were made hourly for 120 hours. These data show that some mortality occurred in only two of the five temperature regimes tested at 5.6 ppm Zn^{++}. For fish exposed to 5.6 ppm Zn^{++}, deaths were recorded for 30°C acclimated fish, and fish acclimated to 20°C but exposed to 30°C at a rate of temperature increase of 1.5°C/10 min. At 10.0 ppm Zn^{++} some mortality occurred at all five test temperatures. Deaths increased at 10.0 ppm Zn^{++} as the rate at which thermal stress was applied increased. (Authors)

14277. Becker, David A. (Water Resources Research Center, Arkansas Univ., Fayetteville, Arkansas). 1971. IMPOUNDMENT EFFECTS ON WATER QUALITY AS REFLECTED IN PARASITISM OF RESERVOIR BASSES. Tech. Completion Report, Water Resources Research Center, 10 p., 13 ref.; Selected Water Resources Abstracts, 4(18): p. 29.

Field investigations involved live collections of the black basses Micropterus dolomieui Lacépède, M. punctulatus (Rafinesque), and M. salmoides (Lacépède). Basses were examined in the laboratory for helminth and copepod parasites in an effort to follow the quantitative and qualitative dispersions and fluctuations of these parasites as the water quality is effected by the water level fluctuations from a river to a reservoir environment. Standard and total length, weight, and scale samples were obtained to ascertain the effect of parasitism on the aging and growth rates of basses which may help explain why sport fishing declines after several years in recently impounded reservoirs effecting the recreational economy of the municipalities surrounding reservoirs. Parasitism were related to the whole food chain in an attempt to establish another parameter for water quality. The comparison of pre-and post-impoundment data was stressed. Results were also compared with other studies involving newly impounded reservoirs.

14278. Becker, C. D. (Battelle-Northwest Lab., Richland, Washington). 1970. TEMPERATURE, TIMING, AND SEAWARD MIGRATION OF JUVENILE CHINOOK SALMON FROM THE CENTRAL COLUMBIA RIVER. Battelle Northwest Laboratories report BNWL-1472, Jul 1970, 21 p.; Selected Water Resources Abstracts, 4(18): p. 30.

A sizeable population of adult chinook salmon now spawns each fall in the free-flowing Hanford environs of the central Columbia River. This population has acquired significance because other vital spawning areas in the mainstem Columbia have been inundated by hydroelectric development. Studies conducted in 1969 show that the progeny of the Hanford population migrates seaward from April to July in the ancient pattern that correlates with favorable water temperatures and high discharge volumes. In contrast, the passage of juvenile chonooks that now issue from upriver reaches is known to be delayed until July and August when temperatures and discharge volumes are less favorable. Temperatures in the central Columbia are modified by discharges of heated effluent from plutonium production reactors at Hanford, in addition to largely seasonal changes in river flow, cooling or warming by the upriver reservoir complex, and summer heat input from the atmosphere. In 1968 and 1969, mean weekly water temperatures peaked in late July, August, and early September with maximum daily temperatures briefly reaching 19.1 and 19.7C, respectively at Priest Rapids and 19.7 and 20.6C at Richland. The relationship of ambient temperatures and river discharges to the natural and delayed migration of juvenile chinooks through the Hanford area is evaluated. Maximum temperatures in the central Columbia seldom exceed 22C and have not been recorded as approaching 25.1C, the apparent upper incipient lethal limit for juvenile chinooks. Although peak summer temperatures (above 20C) may be suboptimum for the survival of young salmon, such conditions probably existed long before the advent of modern man. Present peak temperatures do not appear to be directly lethal even with increments of heat from reactor effluent. Potentially adverse thermal effects from reactor operation would most likely appear at subacute levels and resist casual detection. This assumes that a slight increase in excess of the annual temperature cycle does not greatly intensify other existing environmental hazards.

14279. Fukami, Jun-Ichi, Takashi Shishido, Kazuo Fukunaga, and John E. Casida (Lab. of Insect Toxicology, Inst. of Physical and Chem. Res., Tokyo, Japan). 1969. OXIDATIVE METABOLISM OF ROTENONE IN MAMMALS, FISH, AND INSECTS AND ITS RELATION TO SELECTIVE TOXICITY. Agric. and Food Chem., 17(6): 1217-1226; Selected Water Resources Abstracts, 4(18): p. 31.

Rotenone inhibits the respiration of mitochondria by blocking the reduced nicotinamide adenine dinucleotide (NADH) - dehydrogenase segment of the respiratory chain. It appears that rotenone's selective toxicity, i.e. moderate toxicity to mammals vs. extreme toxicity to fish and insects, depends upon differences in the distribution pattern or in the detoxification rate of rotenone in various organisms. The results of described in vivo and in vitro studies on rotenone detoxification indicate that the effects of components in the soluble fraction of liver homogenates possible are related to the selective toxicity of rotenone to mammals, fish and insects. - LeGore.

14280. Savitz, Jan (Dept. of Biol., Loyola Univ., Chicago, Illinois). 1969. EFFECT OF M.S. 222 ON NITROGEN EXCRETION OF THE BLUEGILL (Lepomis macrochirus). J. Elisha Mitchell sci. Soc., 85(4): 150-151; Selected Water Resources Abstracts, 4(18): p. 32.

Because M.S. 222 (tricaine methanesulphonate) anesthetizes fish, it was also expected to lower their nitrogen excretion rate. Static bioassays were used with pre- and post-treatment water samples being analyzed for nitrogen content. The nitrogen excretion rates for bluegills treated with 0.003% M.S. 222 for one day were not significantly different from those of untreated controls. - LeGore

14281. Svobodova, Z. (Vyzkumny Ustav Rybarsky a Hydrobiologicky Vodnany, Prague, Czechoslovakia). 1970. TOXICITY OF PESTICIDES WITH A HIGH CONTENT OF 4, 6-DINITRO-O-CRESOL FOR FISH. Buletin VUR Vodnany, Vol. 6, p. 20-25, In Czech with English summary; Selected Water Resources Abstracts, 4(18): p. 32.

The toxicity to fish of newly developed pesticides containing 4, 6-dinitro-o-cresol (DNOK) was investigated. The trade compounds were Nitrosan 50, Rafex 50, Zimni postrik I and Zimni postrik II (winter spray I and II). Toxicity depends upon percent DNOK content, upon the response of the pH noxious bath, and upon the nature of the remaining substances contained in the preparation. According to results, it is possible to arrange the preparations in order of decreasing toxicity: Zimni postrik II, Rafex 50, Nitrosan 50 and Zimni postrik I. Nevertheless, all the above must be considered noxious to fish. - LeGore.

14282. Lloyd, R. (FAO of the United Nations, European Inland Fisheries Advisory Comm., Rome, Italy). 1968. WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH. REPORT ON EXTREME PH VALUES AND INLAND FISHERIES. European Inland Fisheries Advisory Commission Technical Paper No. 4, 24 p.; Selected Water Resources Abstracts, 4(18): p. 33.

A normal range of pH values is known to support good fisheries. A critical review is presented of published and unpublished data on direct and indirect effects of extreme pH on fish. There is no definitively established pH range within which a fishery remains unharmed and outside which it is damaged, but there is a gradual deterioration of the fishery as the pH values are further removed from the normal range. A pH range of 5-9 is not directly lethal to fish, but the toxicity of several common pollutants is markedly affected by pH changes within this range. Below pH 5.0, fish mortalities may be expected, and the productivity of a fishery is reduced. Some species may be acclimated to values as low as 3.7. Data on high pH are not extensive and probably reflect the lesser importance of this aspect. pH values between 9 and 10 may be harmful to a few species of fish, and higher levels are lethal to many more. It is observed that fish avoid zones of extreme pH value. - Katz.

14283. Anonymous. 1971. THERMAL POLLUTION FISHKILL. American Assoc. of Professors in Sanitary Engineering Newsletter, 6(3): p. 15 (taken from Sports Fishing Institute Bulletin); Selected Water Resources Abstracts, 4(18): p. 35.

A 720-MW generation unit at a thermal power plant on the Susquehanna River developed a water leak on February 4, 1971 and had to be shut down. This resulted in a sudden drop of water temperature which caused an estimated fishkill of 15, 388 fish of value. A sudden 44F temperature drop-to 36F-caused the kill. This was clearly a thermal-pollution caused fishkill because the fish accumulated below the plant in the vicinity of warm water influence and died of exposure to the cold when the artificial heat had been cut off. The note also mentions thermal pollution studies on rapid water temperature changes, conducted at Vanderbilt University which demonstrates the extremely slow rates of temperature decrease which may still prove fatal to fish. - Oleszkiewicz.

14284. Tagatz, Marlin E., and Ann Bowman Hall. 1971. ANNOTATED BIBLIOGRAPHY ON THE FISHING INDUSTRY AND BIOLOGY OF THE BLUE CRAB, Callinectes sapidus. U. S. Dept. of Comm., NOAA Technical Report NMFS SSRF-640, 94 p.

References are given on 742 publications, published before 1970, on classification, distribution, abundance, life history, morphology, physiology, ecology, fishery, and industry. Annotations and a subject index also are provided. (Authors)

14285. Hardy, C. J. (Fish. Div., Marine Dept. Christchurch, New Zealand). 1971. WINSTON CHURCHILL MEMORIAL TRUST FRESHWATER FISHERIES STUDY TOUR OF NORTH AMERICA 15 AUGUST 1970 - 9 NOVEMBER 1970. New Zealand Marine Dept. Fisheries Technical Report No. 73, 216 p., illus.

14286. Jones, Albert R. 1970. INVENTORY AND CLASSIFICATION OF STREAMS IN THE LICKING RIVER DRAINAGE. Kentucky Fisheries Bulletin No. 53, 62 p.

Streams of fishery importance in the Licking River Drainage were listed and classified on the basis of stream order. Some of the physical, chemical and biological characteristics of the streams are described as well as the general characteristics of the fishery. The Licking River Drainage includes approximately 1,418 miles of stream capable of providing a sport fishery. Ten streams (328 miles) were considered to be of outstanding quality while approximately 116 miles (8%) have been degraded by pollution. Siltation is the primary form of stream degradation in the Licking River Drainage. Sewage pollution has been detrimental to the fish population in two streams in the drainage. A grand total of 92 species of fishes representing 15 families were identified from the Licking River Drainage. The bluntnose minnow was the most abundant species while only one specimen of each of the following species was recorded: quillback, carpsucker, longnose gar, southern redbelly dace, slenderhead darter, gilt darter, river redhorse and Carolina madtom. (Auth.)

14287. Waller, William T., M. L. Dahlberg, Richard E. Sparks, and John Cairns, Jr. (Biol. Dept. and Center for Environ. Studies, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. A COMPUTER SIMULATION OF THE EFFECTS OF SUPERIMPOSED MORTALITY DUE TO POLLUTANTS ON POPULATIONS OF FATHEAD MINNOWS (Pimephales promelas). J. Fish. Res. Bd. Canada 28(8): 1107-1112.

This computer simulation study tested the effects of 99 levels of proportional mortality on fathead minnow (Pimephales promelas) populations, assuming that the parent-progeny relationship is of the form proposed by Ricker. Limited data from two studies on three lakes were available to fit the model and obtain estimates of parameters for fathead minnow populations. Based on these estimates, 25 replications of a 50-generation cycle were simulated under two levels of environmental variability. Arbitrary extinction levels of 5, 100, and 500 females had little effect on the results. Increasing environmental variation lowered the percentage mortality at which population extinctions occurred. In general, the results are compatible with the recommendation of the U. S. Committee on Water Quality Criteria, that the maximum concentration of zinc to which fish could be continuously exposed should not exceed $\frac{1}{100}$ the 96-hr TL_m (median tolerance limit) – a concentration that caused a 50% reduction in the mean number of eggs laid per female by fathead minnows in a laboratory study. (Authors)

14288. Ringrose, R. C. (Dept. of Animal Sciences, Univ. of N. H., Durham, New Hampshire). 1971. CALORIE-TO-PROTEIN RATIO FOR BROOK TROUT (Salvelinus fontinalis). J. Fish. Res. Bd. Canada 28(8): 1113-1117.

Based upon a kilogram of feed, the results suggested that the brook trout (Salvelinus fontinalis) required approximately 75 kcal of metabolizable energy for each 1% of protein in the feed. Additional feed energy, resulting in greater calorie-to-protein ratios, reduced weight gained but did not significantly increase fat content of the dry carcass. The carbohydrate and protein of wheat middlings were utilized by the trout. A toasted cereal product composed of 80% corn and 20% wheat was metabolized for energy. Delactosed dried whey was found less effective than glucose as an energy source for trout. (Auth.)

14289. Brungs, William A. (Environ. Protection Agency, Newtown Fish Toxicology Lab., Cincinnati, Ohio). 1971. CHRONIC EFFECTS OF LOW DISSOLVED OXYGEN CONCENTRATIONS ON THE FATHEAD MINNOW (Pimephales promelas). J. Fish. Res. Bd. Canada 28(8): 1119-1123.

Fathead minnows were exposed to constant dissolved oxygen concentrations (1.0-5.0 mg/liter) for 11 months. The number of eggs produced per female was reduced at 2.0 mg/liter; no spawning occurred at 1.0 mg/liter. Fry growth was reduced significantly at all concentrations below the control (7.9 mg/liter). Fry survival was reduced at 4.0 mg/liter and lower dissolved oxygen concentrations; 18% of the survivors at 4.0 mg/liter were deformed. The time required for hatching was increased at successively lower oxygen concentrations by as much as 50% (from 5.0 under control conditions to 7.8 days at 2.0 mg/liter), but no effect on percentage hatch was observed. (Auth.)

14290. Dingle, J. R., and J. A. Hines (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1971. DEGRADATION OF INOSINE 5'-MONOPHOSPHATE IN THE SKELETAL MUSCLE OF SEVERAL NORTH ATLANTIC FISHES. J. Fish. Res. Bd. Canada 28(8): 1125-1131.

The rates of breakdown of inosine 5'-monophosphate (IMP) and of its product, inosine (Ino), varied considerably in the muscles of Atlantic cod, haddock, pollock, Atlantic halibut, American plaice, and winter flounder when stored in ice. Haddock and Atlantic halibut were noteworthy in having a very slow rate of breakdown of IMP in relation to the other species. Variations of the rate of dephosphorylation of IMP among individual winter flounder appear to be due to differences in muscle pH. In homogenates of the muscles investigated, the maximum rates of breakdown of IMP occurred in the pH range 8.6-9.4, and were much greater than in the pH range of muscle. The effect of pH on the breakdown of Ino was less pronounced. In haddock and Atlantic halibut there was little or no loss of endogenous IMP when the muscle was cooked at 260 or 100 C; IMP added to Atlantic cod before cooking was also stable. (Authors)

14291. Ferguson, R. G., and A. J. Derksen (Ont. Dept. of Lands and Forests, Lake Erie Fish. Res. Sta., Wheatley, Ontario, Canada). 1971. MIGRATIONS OF ADULT AND JUVENILE WALLEYES (Stizostedion vitreum vitreum) IN SOUTHERN LAKE HURON, LAKE ST. CLAIR, LAKE ERIE, AND CONNECTING WATERS. J. Fish. Res. Bd. Canada 28(8): 1133-1142.

Recoveries of walleyes (Stizostedion vitreum vitreum) tagged as adults and juveniles at various sites in waters from southern Lake Huron to eastern Lake Erie provided information on the migrations of the Thames River stock and the mixing of these fish with other stocks in the study area. Walleyes spawning in the Thames River in March and April quickly migrated into the St. Clair River and southern Lake Huron, where they mingled with other stocks, including some from Lake Erie. The return migration to the Thames River occurred between November and March. Juvenile walleyes tagged in Lake St. Clair, on the other hand, moved downriver to Lake Erie. Young-of-the-year fish tagged in western Lake Erie, many presumably of Lake St. Clair origin, provided evidence of a reverse migration, since they tended to move back into Lake St. Clair and Lake Huron as they matured. Adult walleyes tagged along the Canadian shore of Lake Erie migrated eastward during the summer, but were recovered in or near the western basin during the spawning season. Thus, western Lake Erie appeared as a juvenile milling or mixing area during the summer, whereas southern Lake Huron and the north shore of central and eastern Lake Erie were adult areas. (Authors)

14292. Kennedy, V. S., and D. H. Steele (Dept. of Biol. Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1971. THE WINTER FLOUNDER (Pseudopleuronectes americanus) IN LONG POND, CONCEPTION BAY, NEWFOUNDLAND. J. Fish. Res. Bd. Canada 28(8): 1153-1165.

Monthly samples of winter flounder taken in Long Pond from November 1962 to October 1963 indicated that the flounder moved into deeper water (7-10 m) during the summer and returned to shallow water (1-2 m) from September to June. These movements corresponded to the end of the spawning season and the ripening of the gonads respectively. Spawning occurred from March until early June, most of it in May and early June. Most males were mature at age 6 and most females at age 7. Fifty percent of the males and females were mature at 21 and 25 cm respectively. The growth rates of the males and females were similar until the age of 8, after which the females apparently outgrew the males. Early growth and fecundity were similar to those reported for other areas. No feeding took place in December or January but the flounder fed in March and continued to feed throughout the summer; food intake decreased in the fall. They were omnivorous and the type of food eaten varied with the locality. Polychaetes, plant material, and molluscs were the most common food items throughout the year. Capelin eggs and fish remains were found only during a few months of the year but were eaten in great quantities. (Authors)

14293. Leggett, William C., and Robert A. Jones (Essex Marine Lab., Essex, Connecticut). 1971. NET AVOIDANCE BEHAVIOR IN AMERICAN SHAD (Alosa sapidissima) AS OBSERVED BY ULTRASONIC TRACKING TECHNIQUES. J. Fish. Res. Bd. Canada 28(8): 1167-1171.

During tracking of 13 adult American shad (Alosa sapidissima) with ultrasonic transmitters in 49 approaches to commercial drift gillnets in the lower Connecticut River, only one shad was captured. Typically, shad moved to within 1-2 m of the net before sensing its presence, then turned and swam along the net, close to the mesh, to its end, where they turned and continued their upriver migration. Sight appeared to play an important role in net detection. However, 14 avoidances were observed when light intensities were inadequate to allow visual detection of the mesh. It was concluded that other senses, perhaps the lateral line, also function in net avoidance, especially when sight is impaired. (Authors)

14294. Qureshi, M. D., R. V. Hledin, W. E. Vanstone, and P. A. Anastassiadis (Dept. of Agric. Chem., Fac. of Agric., McGill Univ., Macdonald College Post Office, Quebec, Canada). 1971. LEVELS OF CONSTITUENTS OF GLYCOPROTEINS IN THE SERA OF PACIFIC SALMON. J. Fish. Res. Bd. Canada 28(8): 1173-1179.

The levels of hexosamine, sialic acid, fucose, and protein in serum of sockeye salmon (Oncorhynchus nerka) and, to a limited extent, in sera of coho salmon (O. kisutch) and chinook salmon (O. tshawytscha) at two reproductive stages, were determined. Hexosamine, sialic acid, fucose, hexose, seromucoid, and protein content of sexually maturing (early) and mature (spawning) sockeye salmon were studied and a comparison was attempted with the corresponding composition of bovine serum. Content of the above serum constituents was lower in spawning than in maturing populations. Protein content was much less, hexosamine a little less, and sialic acid higher, in the sera of sockeye salmon than in bovine serum. The protein-carbohydrate complex of serum appeared to contain more hexosamine and much more sialic acid than the protein-carbohydrate complex of bovine serum. Furthermore, the sialic acid-to-hexosamine ratio was much higher in sera of salmon than in bovine serum. Some other sex and reproductive stage differences were detected and reported. (Authors)

14295. Welander, Arthur D., Gerald W. Wadley, and Douglas K. Dysart (Lab. of Radiation Ecology, Coll. of Fish., Univ. of Wash., Seattle, Washington). 1971. GROWTH AND FECUNDITY OF RAINBOW TROUT (Salmo gairdneri) EXPOSED TO SINGLE SUBLETHAL DOSES OF X-RAYS DURING THE EYED EMBRYO STAGE. J. Fish. Res. Bd. Canada 28(8): 1181-1184.

When rainbow trout (Salmo gairdneri) were reared for 2 years after irradiation with 21, 83, and 203 roentgens (R) during the eyed stage, the irradiation had no demonstrable effect on survival, growth, or fecundity. The trout were reared at temperatures of 15.4 and 17.2 C in parallel experiments for 160 days after fertilization. At the end of 2 years 65 female trout (and 56 males), averaging more than 1400 g in weight, produced 186,400 eggs. Egg production was not related to irradiation dose or temperature; however, there was a slight dose-related increase in number surviving to the eyed stage in most of the irradiated groups. (Authors)

14296. Scott, K. R. (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1971. MONITORING OF FISH TANK OXYGEN CONCENTRATION USING A DIGITAL RECORDER. J. Fish. Res. Bd. Canada 28(8): 1196-1197.

A method for monitoring fish tank oxygen concentrations at 10-min intervals is described. The millivolt output from a temperature-compensated oxygen meter is connected to a clocked digital datalogger system having a perforated paper tape output. Results from two widely different sets of operating conditions are analysed and automatically plotted using a prewritten computer program. (Auth.)

14297. Trust, T. J. (Dept. of Bacteriology and Biochemistry, Univ. of Victoria, Victoria, British Columbia, Canada). 1971. BACTERIAL COUNTS OF COMMERCIAL FISH DIETS. J. Fish. Res. Bd. Canada 28(8): 1185-1189.

Two diets formulated and offered for commercial fish production were examined to determine their microbial burden. The total count of aerobic bacteria ranged from 10^3 to 10^7 bacteria per gram of diet. The diets contained psychrophilic and thermophilic species and up to 10^4 aerobic and anaerobic spore-forming bacteria per gram. Enterococci and members of the Enterobacteriaceae, including species of Salmonella, were also present. Fluorescent pseudomonads were detected in 18 of the 47 samples tasted. Proteolytic, amylolytic, lipolytic, and haemolytic organisms were shown to be present in measurable numbers. The total viable aerobic count did not change markedly on storage of representative samples at 4, 20, or 30 C. (Auth.)

14298. Uthe, J. F. (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1971. A SIMPLE FIELD TECHNIQUE FOR OBTAINING SMALL SAMPLES OF MUSCLE FROM LIVING FISH. J. Fish. Res. Bd. Canada 28(8): 1203-1204.

A method for obtaining small samples of muscle from living fish is described. The procedure employs a modified Silverman biopsy needle and samples of approximately 40 mg are obtained. Survival rate in a group of fish held in aquaria and periodically biopsied is excellent. Quantitative mercury analyses were carried out on multiple biopsy samples from a group of fish and the precision of the results is as good as that obtained when analyses were carried out on excised portions of muscle. (Auth.)

14299. Bourget, E., and G. Lacroix (Departement de biologie, Universite Laval, Quebec, Quebec, Canada). 1971. TWO SIMPLE DURABLE EPIFAUNAL COLLECTORS. J. Fish. Res. Bd. Canada 28(8): 1205-1207.

Vertical and horizontal epifaunal collectors, especially for the infralittoral zone, are described. Special attention is given to stability of the collectors and to easy recovery and replacement of the test panels. The collectors were used under severe environmental conditions and were found very satisfactory. Species collected by the two collectors differed greatly. The vertical collector yielded the greater variety of species, and the horizontal collector the greater number of specimens. (Authors)

14300. Metroka, C. E., J. V. Chuba, W. J. Kuhns, R. F. Nigrelli and G. D. Ruggieri (Dept. of Pathology, N. Y. Univ. School of Medicine, N. Y., New York). 1971. KILLIFISH "HEMAGGLUTINOGENS". J. Fish. Res. Bd. Canada 28(8): 1208-1210.

The "blood-group" activities of mummichog and striped killifish erythrocytes were compared on the basis of monosaccharide agglutination-inhibition tests. Crude wheat germ lectin and some human sera (regardless of A-B-O blood-group status) were shown to contain antikillifish hemagglutinins that were variably inhibitable with N-acetyl-glucosamine and other A-B-O-inactive monosaccharides. (Authors)

14301. Silliman, R. P. (NMFS Biol. Lab., Seattle, Washington). 1971. ADVANTAGES AND LIMITATIONS OF "SIMPLE" FISHERY MODELS IN LIGHT OF LABORATORY EXPERIMENTS. J. Fish. Res. Bd. Canada 28(8): 1211-1214.

"Simple" fishery models as treated herein are those requiring only catch and effort data for fitting. In the models described, the yield-on-biomass curve is considered equivalent to the growth curve of the population: Schaefer, logistic; Fox, Gompertz; Pella and Tomlinson, generalized. The Fox model is more realistic for fish populations than the Schaefer, eliminating the constraint of a symmetrical yield curve. The Pella-Tomlinson model is general, including the others as special instances. Tests against data from laboratory populations of guppies support the validity of the Fox and Pella-Tomlinson models. The Fox model is the simpler to fit of the two (as it has less parameters) and has been shown to be appropriate for a number of commercial fisheries. Advantages of the models

include their minimal requirements for basic data and relative ease of fitting. Limitations include lack of provision for reproductive lag and waste of biological information other than catch and effort. (Auth.)

14302. Dominy, C. L. (Resource Development Branch, Fish. Serv., Dept. of the Environ. of Canada, Halifax, Nova Scotia, Canada). 1971. CHANGES IN BLOOD LACTIC ACID CONCENTRATIONS IN ALEWIVES (Alosa pseudoharengus) DURING PASSAGE THROUGH A POOL AND WEIR FISHWAY. J. Fish. Res. Bd. Canada 28(8): 1215-1217, illus.

Blood lactic acid concentration of anadromous alewives (Alosa pseudoharengus) sampled during their upstream migration through a pool and weir fishway was not extremely high (46.7 mg/100 ml) and the degree of exercise exhibited during ascent was judged to be moderate. For fish that were subjected experimentally to severe exercise, the concentration (108.7 mg/100 ml) was more than five times that for rested fish (18.9 mg/100 ml). Of the three groups of fish sampled directly from the fishway pools, only one had an average concentration that differed significantly from that of the rested state. (Auth.)

14303. Snow, Howard E. (Bur. of Research, Spooner, Wisconsin). 1971. HARVEST AND FEEDING HABITS OF LARGEMOUTH BASS IN MURPHY FLOWAGE, WISCONSIN. Dept. of Natural Resources, Madison, Wisconsin Technical Bulletin No. 50, 25 p.

From 1955 through 1969, the harvest and feeding habits of largemouth bass in Murphy Flowage were studied under liberalized fishing regulations and a compulsory creel census. The annual harvest of bass by anglers averaged 2.7 fish or 2.8 pounds per acre. Bass fishing was most productive during May and June and before 8 a.m. and after 8 p.m., the catch of female bass exceeding the catch of male bass during all months except June. In contrast to almost equal use of live baits and artificial lures, about 75 percent of all bass were taken on artificial lures. The introduction and subsequent popularity of new lures affected the annual percentages of bass taken on different types of artificial lures. The greatest number and the largest fish were taken on artificial lures. Feeding habits were influenced by degree of satiation, sex of fish, spawning activities, water temperature and time of day. Of the total weight of all items consumed by bass, crayfish comprised 54.6 percent, fish (mainly bluegills and bullheads), 38.8 percent and insects, 1.5 percent. As bass increased in size, the size of bluegills and crayfish consumed increased, but the size of bullheads consumed did not. The ratio of prey length to predator length, however, generally decreased with increasing sizes of bass for crayfish and bullheads but not for bluegills. Factors found to affect bass selectivity of bullheads, bluegills and crayfish were preference, accessibility and abundance, respectively. Prior to an overwinter drawdown, crayfish were the most important item consumed, bullheads were positively selected and bluegills were neither selected nor avoided. After the drawdown, which was accompanied by a known decline in aquatic vegetation abundance and an apparent decline in crayfish abundance, consumption of bluegills increased. In environments where bullheads and/or abundant crayfish are present in the same body of water as bluegills, drawdown might be used to alter the feeding habits of bass to make bass more selective predators on bluegills. (Auth.)

14304. Post, George (Wildlife Biol., Colo. State Univ., Fort Collins, Colorado). 1971. THE Diphyllobothrium CESTODE IN YELLOWSTONE LAKE, WYOMING. Agric. Exp. Sta., Univ. of Wyoming, Laramie, Research Journal 41, 24 p., illus.

Diphyllobothrium cordiceps has been known in its plerocercoid stage in fishes of Yellowstone National Park since the first formal publication by Leidy in 1872. Linton gave the first description of adult cestodes taken from pelicans in 1891. Several research workers have visited Yellowstone National Park since that time and made observations on avian and mammalian definitive hosts of the cestode. Incidence of infection in various second intermediate hosts and definitive hosts was noted. The plerocercoid stage in fishes was transmitted to dogs, cats, pelicans and California gulls under experimental conditions. Measurements and

morphological data were gathered on cestodes collected from natural infections and from experimental infections. These data are inadequate for identification of the cestode from the various definitive hosts. However, the cestode is considered to be D. cordiceps when found as the adult in the white pelican. Other species of Diphyllobothrium also may be involved. Morphological data on D. cordiceps do not indicate a basis for separation from D. latum. The life cycle is considered to be from adult cestodes in pelicans, California gulls, possibly bears, experimentally in dogs and cats; to an unknown invertebrate in the waters of Yellowstone National Park (an organism taken as food by fishes); to the trouts and grayling which inhabit Yellowstone National Park waters; to the definitive hosts which feed on infected fishes. (Auth. conclusions)

14305. FAO of the United Nations (Rome, Italy). 1971. FAO AQUACULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF AQUACULTURE RESEARCH AND DEVELOPMENT. FAO Aquacult. Bull., 3(3): 24 p., illus.

Text includes: From research institutions... Propagation of the grey mullet - Propagation of sturgeon - Breeding of Brycon henni - Propagation of African catfish - Hybridization of mahseer and common carp - Growth rate of shrimps - Dry feed for postlarval shrimp - Pond culture of African catfishes - Culture of Chinese carps - Acclimatization of salmon fry to seawater - Revival of rotenone-treated fish - Fish-cum-duck raising - Vegetation cover for pond dikes - Temperature tolerance of roach and rudd - Use of heated water for fish culture - Fish culture in heated lakes - Fish culture in domestic waste water - Use of sugar factory wastes - Controlled eutrophication. Aquaculture development... Australia - Hungary - United States. Diseases and their control... Serological typing of IPN virus - Control of bacterial gill disease in rainbow trout - Whirling disease in Italy - Protozoan parasite of Heterotis niloticus fry - Control of argulosis and lernaeasis - "Necrosis" in shrimp - Residues in fish - Temperature and the development of parasites and diseases - Fish pathology studies at the Zoological Society of London. Fish introductions... Recent introductions - Fish introductions in Czechoslovakia - First introduction of rainbow trout in Albania - Trout and salmon plantings in the Great Lakes of North America - Introduction of grass carp in Sweden. (From contents)

14306. Hunt, Robert L. 1971. RESPONSES OF A BROOK TROUT POPULATION TO HABITAT DEVELOPMENT IN LAWRENCE CREEK. Wisconsin Dept. of Natural Resources Technical Bulletin No. 48, 35 p., illus.

Man-made modifications of trout habitat in the upper mile (section A) of Lawrence Creek were followed by significant increases in standing crops of wild brook trout (Salvelinus fontinalis), angler use, and yield. During the 3 years (1965-67) after completion of development, average annual biomass at age 0 and older trout was 41% greater than the average for the 3-year predevelopment period (1961-63). Biomass of age I and older trout increased by an average of 57% and biomass of age II+ trout increased by an average of 141%. An obvious stockpiling effect was evident, a result primarily of improved overwinter survival after development. Trout production (total growth) also increased after development, especially in age II+ stocks. A greater proportion of the increased annual production was also tied up in the standing crop, and as a result of increased angler harvest, more of the trout flesh produced annually was harvested. Both angler use and yield in developed section A increased nearly 200%. Prior to development in section A, it received less fishing pressure than any of the other 3 study sections (18% of total). After development, section A received nearly as much fishing pressure (46% of total) as the other 3 sections combined. Comparisons of trout population and fishery parameters involving all 4 study sections strongly supported the conclusion that the consistently greater improvements in these parameters in section A during the latter 3-year period of study were attributable to changes in trout habitat resulting from development. Multiple and partial correlation analyses involving 6 environmental variables and 4 trout population variables measured in each of 17 stations in section A indicated that trout carrying capacity of undeveloped section A was limited by the physical quality of the habitat, especially the amount

of pool area and permanent bank cover. Both of these environmental components were greatly increased by the development and the trout population increased in response. Trout carrying capacity was poorly correlated with surface area, both before and after development. Expressions such as number of trout/acre or pounds/acre would have been ecologically meaningless. Estimated cost of development was $26,200 or $1,050/year prorated over a functional period of 25 years. On the basis of increased angler use which averaged 300 more trips/season after development, and a theoretical recreational value of $5.00/trip, only 17 years would be required to redeem the expenditure for development. Annual cost of development did not compare favorably with the annual cost of stocking legal-sized domestic trout ($1,050 vs. $132) in numbers sufficient to supply an increased harvest of 200 trout over 8 inches, the average observed increase for the post-development period of study. Pragmatic and philosophic reasons for rejecting the latter cost-benefit criterion are discussed. (Auth.)

14307. Thorslund, Anders E. (Dept. of Fish., Fish. Resources Div., European Inland Fish. Advisory Comm., Rome, Italy). 1971. POTENTIAL USES OF WASTE WATERS AND HEATED EFFLUENTS. I. THE USE OF DOMESTIC WASTE WATER FOR FISH CULTURE IN POLAND. FAO of the UN, EIFAC Occasional Paper No. 5, pp. 3-8, illus.

In Poland detailed investigation of fish culture in biologically treated waste water proved that crucian carp can be cultivated all the year in undiluted effluents from an activated sludge plant. It is recommended to use two-year-old carp since carp fry are adversely affected by retention times shorter than ten days and low oxygen concentration. These larger fish also have better treatment effect on the effluents. Fish yields over 1000 kg/ha were obtained without artificial feeding. Short notes are given on places where wastes of different types are utilized for fish culture. (Auth.)

14308. Thorslund, Anders E. (Dept. of Fish., Fish. Resources Div., European Inland Fish. Advisory Comm., Rome, Italy). 1971. POTENTIAL USES OF WASTE WATERS AND HEATED EFFLUENTS. II. TREATMENT IN FISH PONDS OF WASTES FROM A SUGAR FACTORY. FAO of the UN, EIFAC Occasional Paper No. 5, pp. 9-12.

Experiments undertaken in Poland on fish culture in sugar beet factory wastes show that fish culture in a yearly cycle is possible and that very good treatment effects as well as good fish yields can be obtained. Effluents are collected and stored during autumn and winter. In spring the effluents are diluted according to the self-purification obtained and led to ponds which are then stocked with carp. Before winter the fish ponds are emptied into the recipient and the fish are caught for consumption. Fish culture in waste effluents should be further encouraged especially in developing countries in order both to control water pollution and to obtain cheap and much needed proteins. (Auth.)

14309. Thorslund, Anders E. (Dept. of Fish., Fish. Resources Div., European Inland Fish. Advisory Comm., Rome, Italy). 1971. POTENTIAL USES OF WASTE WATERS AND HEATED EFFLUENTS. III. BIOLOGICAL CONTROL AND UTILIZATION OF HEATED EFFLUENTS, KONIN PROJECT. FAO of the UN, EIFAC Occasional Paper No. 5, pp. 13-23.

Detailed investigations are carried out on the biological effects of heated effluents on a system of five interconnected lakes in central Poland which are used as circulating cooling system for two base-load thermopower stations. The eutrophication has been turned into valuable fish production through a combination of increased growth rates and introduction of eel, common carp, and Chinese carps. Thanks to the strict biological management, no adverse growth of aquatic plants or plankton has occurred, the latter being of vital importance for the operation of the power stations. (Auth.)

14310. Rohdy, D. D. and R. E. Lovegrove (Dept. of Economics, Colo. State Univ., Fort Collins, Colorado). 1970. ECONOMIC IMPACT OF HUNTING AND FISHING EXPENDITURES IN GRAND COUNTY, COLORADO, 1968. Colo. State Univ. Exp. Sta., GS 916, 36 p., illus.

14311. Shih, C.-T., A. J. G. Figueira, and E. H. Grainger (National Museum of Natural Sciences, Canadian Oceanographic Identification Centre, Ottawa, Canada). 1971. A SYNOPSIS OF CANADIAN MARINE ZOOPLANKTON. Fish. Res. Bd. of Canada Bulletin 176, 264 p. plus map.

This Bulletin compiles the literature published prior to 1970 on marine zooplankton of Canadian waters in three sections: Atlantic, Pacific, and Arctic, each containing Records of species and a Bibliography. Each entry of the Records is provided with the reference, information on occurrence of the species, and when available, remarks on life history, ecology, and taxonomy. The Bibliography gives a complete citation of all references. An integrated index of generic and specific names is included. (Authors)

14312. Girardi, F., Margaret Merlini, Carla Bigliocca, G. Pozzi, and A. Berg (Divisions of Nuclear Chem. and Biol., EURATOM CCR, Ispra, Italy). 1970. A RADIOTRACER TECHNIQUE FOR THE STUDY IN VIVO OF THE BIOLOGICAL PATHWAY OF HEAVY METALS IN AQUATIC ORGANISMS. Symposium Salzburg "Nuclear Techniques in Environmental Pollution": pp. 721-733.

While whole-body counting in vivo permits the accumulation of the radiotracer in the whole animal, it is necessary to sacrifice many specimens at various intervals of time in order to establish the rates of uptake and final concentration in the various organs and tissues of the organism. The possibility of direct in vivo measurements of the radioactivity of specific organs by means of a collimated detector is being studied. With this method it is possible to investigate the dynamic biological pathway of the pollutant during the absorption process in a single organism. The system, which is still in the developmental stage, is designed both to determine complete radioactivity mapping of the animal and at discrete points. It can be coupled with an automated gamma-ray spectrometer for multi-tracer experiments. Fast data analysis is made possible by direct connection with an IBM 360/65 computer. The system is described and data on its performances is given. Preliminary results obtained in practical applications to freshwater organisms are presented. (Authors)

14313. Witt, Larry A. (Nebr. Game and Parks Comm., Lincoln, Nebraska). 1970. THE FISHES OF THE NEMAHA BASIN, NEBRASKA. Trans. Kansas Acad. Sci., 73(1): 70-88.

The possible effects of proposed watershed management practices on fish resources of the Nemaha Basin were poorly understood; thus, a study was undertaken to ascertain the species of fish present and their relative abundance and distribution within the basin. Thirty-five species were collected, 34 of them from the Big Nemaha River system and 28 from the Little Nemaha River system. These data may be used as a basis for future studies of fish population changes in the Nemaha Basin and possibly as a basis for studies in other watersheds. (Auth.)

14314. Witt, Larry A. (Nebr. Game and Parks Comm., Lincoln, Nebraska). 1969. THE OCCURRENCE OF THE BLACKNOSE DACE, Rhinichthys atratulus (Hermann) IN SOUTHEASTERN NEBRASKA. Amer. Midl. Nat., 81(2): 80-82.

A recent survey of the fishes of southeastern Nebraska revealed the presence of blacknose dace, Rhinchthys atratulus, in a small spring-fed stream. Prior to our survey, this species was known only from a local area in northeastern Nebraska and had not been reported since 1942. (Auth.)

14315. Schäperclaus, Wilhelm. 1970. RESULTS OF EXPERIMENTS ON PRODUCTION OF ANTIGENS FOR IMMUNIZATION OF CARP AGAINST Aeromonas punctata. (Experimentelle Untersuchungen zur Ermittlung der wirksamsten Impfantigene für eine aktive Immunisierung von Karpfen gegen Aeromonas punctata). Z. Fischerei NF Bd. 18(3-4): 227-257.

This is a very detailed study of immunization of carp against disease caused by Aeromonas punctata (A. liquefaciens). About 10 years ago the author introduced a method of protecting carp from spring outbreaks of infectious dropsy by intraperitoneal injection of chloramphenicol. Such prophylaxis proved very valuable

but it is of short duration. Injection of chloramphenicol has some adverse properties, one being reduced immunologic protective response caused by inapparent or light infection. To overcome this the author recommends simultaneous injection of chloramphenicol with a polyvalent vaccine prepared from a mixture of killed bacteria, endotoxin and hemolysin. Such prophylaxis provides immediate protection and immunization. Oral immunization is also possible but of lesser value. Experimental data supporting the author's recommendations are too voluminous and too complex to permit preparation of a meaningful summary. -- S. F. Snieszko

14316. Steffens, Werner. 1970. REVIEW OF RESULTS AND PERTAINING TO PROBLEMS OF NUTRITION OF FISHES UNDER CONDITIONS OF INTENSIVE PRODUCTION. (Ergebnisse und Probleme auf dem Gebiet der Ernahrung von Fischen unter industriemassigen Produktionsbedingungen). Z. Fischerei NF Bd. 18(3-4): 195-207.

A survey is given of the present knowledge in the field of nutrition physiology of fish under conditions of industrialized production. Special emphasis is laid on carp (Cyprinus carpio) and rainbow trout (Salmo gairdneri). The following problems are discussed: the importance of dry feedstuffs for intensive fish production; their applicability with various fish species and at various stages of growth; the appropriate composition of the dry feedstuffs with regard to their content of protein, carbohydrates, fat and vitamins; the achievable increment; the feed input; the practical implementation of feeding; and aspects of nutrient economy. (Auth. summ.)

14317. Priegel, Gordon R. 1971. EVALUATION OF INTENSIVE FRESHWATER DRUM REMOVAL IN LAKE WINNEBAGO, WISCONSIN, 1955-1966. Wisconsin Dept. of Natural Resources Technical Bulletin No. 47, 28 p., illus.

An intensive freshwater drum removal program was undertaken on Lake Winnebago with the assistance of qualified commercial fishermen in 1955. A 12-year evaluation study, 1955-1966, was initiated at the start of the intensive removal program to evaluate the effects of freshwater drum removal on the freshwater drum population and other fish species. From 1955 through 1966, 35.5 million pounds of commercial fish were removed from Lake Winnebago. Of this total, 33.4 million pounds were freshwater drum. Initial heavy removal, 11.8 million pounds of freshwater drum in 1955-57, resulted in a decided change in the condition of the freshwater drum; however, the improvement in condition that was evident early in the study tended to be lost later. The commercial harvest was intensive enough to crop off the larger and older freshwater drum by 1962 so that the harvest after 1962 was composed of smaller and younger fish even though the rate of growth remained the same. Selected trap net sets during April-June and trawling during the summer and autumn were effective methods of removing freshwater drum. To keep the freshwater drum population at an optimum size in Lake Winnebago, 2.5-3.0 million pounds should be removed annually. Since the freshwater drum is a very prolific fish and occupies a favorable habitat, the population would soon consist of many slow-growing, old-age fish, which was the situation before the program began in 1955, if maximum effort is not maintained. There were benefits to the sport fishery that appeared to result from the freshwater drum removal program; however, no positive correlation could be demonstrated. After 1959, the catch of white bass and black crappie in nets definitely increased. Walleye, sauger and yellow perch populations fluctuated in abundance but the catch in nets after 1959 increased, especially that of the sauger. There was no indication thet commercial removal of freshwater drum was detrimental to any game or panfish population. (Auth.)

14318. Ovchynnyk, Michael M. 1971. FRESHWATER FISHES OF ECUADOR AND PROSPECTS FOR DEVELOPMENT OF THEIR CULTURE. (Peces de Agua Dulce del Ecuador y Perspectivas para desarrollar su cultivo). Latin American Studies Center, Michigan State Univ., Monograph Series No. 1, 68 p., illus., In Spanish.

14319. Paperna, I., and M. Lahav (Lab. for Res. of Fish Diseases, Nir David, Israel). 1971. NEW RECORDS AND FURTHER DATA ON FISH PARASITES IN ISRAEL. Bamidgeh, 23(2): 43-52, illus.

Surveys of fish parasites, particularly of fish used for pond stocking (mullets and cichlids, as well as carp), have been carried out in Israel continuously since 1957. In addition, pond fish suspected of infection or disease, as well as fish from ponds having an outbreak of mortality, are sent for examination to the Laboratory for Research of Fish Diseases in Nir David. The present communication deals with data on fish parasites collected since 1964, when a large scale survey of fish parasites was completed. (Authors)

14320. Hines, R., A. Yashouv, and A. Wilamovski (Fish Culture Research Sta., Dor, Israel). 1971. DIFFERENCES IN THE ELECTROPHORETIC MOBILITY OF THE HEMOGLOBINS OF Tilapia aurea, Tilapia vulcani, AND THEIR HYBRID CROSS. Bamidgeh, 23(2): 53-55.

The F-1 hybrid of Tilapia aurea (male) and Tilapia vulcani (female) is a popular cultured fish in Israel because of its skewed sex ratio and good growth characteristics. Because of problems encountered in morphologically differentiating the parent stock and the hybrid, an alternative method of species identification was sought. Muscle myogen patterns of T. aurea and T. vulcani were examined using starch-gel electrophoresis but differences between their muscle myogens were not detected. Polyacrylamide gel separations of the muscle myogen material showed variation which did not appear to be species correlated. It has been reported that polymorphism can occur within the hemoglobins of closely related fish species or the same species. The hemoglobins of T. aurea, T. vulcani, and their hybrid were, therefore, examined electrophoretically for differences which might be useful in differentiating the parent stock. (Authors)

14321. Clemmer, Glenn H., and Royal D. Suttkus (Dept. of Zool., Miss. State Univ., State College, Mississippi). 1971. Hybopsis lineapunctata, A NEW CYPRINID FISH FROM THE UPPER ALABAMA RIVER SYSTEM. Tulane Studies in Zoology and Botany, 17(2): 21-30, illus.

A new cyprinid, Hybopsis lineapunctata, is described from above the Fall Line in the Coosa and Tallapoosa rivers, Mobile drainage. The coarse scales, usually 20-22 around the body, and the dark lateral band are diagnostic characters. H. lineapunctata is compared with Hybopsis amblops from the Tennessee River, the most closely related form. (Authors)

14322. Byrne, John E. (Dept. of Zool., Univ. of Br. Columbia, Vancouver 8, British Columbia, Canada). 1971. A FURTHER CONTRIBUTION TO USING ULTRASONIC SENSORS FOR FISH ACTIVITY STUDIES. Trans. Amer. Fish. Soc., 100(4): 792-794.

High frequency sound has received limited attention as a technique to record fish activity. This paper reports the application of one technique to a study of spontaneous locomotor activity cycles in juvenile sockeye salmon (Oncorhynchus nerka Walbaum).

14323. Schmittou, H. R. (Auburn Univ. Agric. Exp. Sta., Auburn, Alabama). 1970. THE CULTURE OF CHANNEL CATFISH, Ictalurus punctatus (Rafinesque), IN CAGES SUSPENDED IN PONDS. Proc. of the 23rd Ann. Conf. Southeastern Assoc. of Game and Fish Commissioners, Oct. 19-23, 1969, pp. 226-244.

Since 1966, a study has been conducted in earthen ponds of the Auburn University Agricultural Experiment Station, Auburn, Alabama, to evaluate the potential of suspended cages for culturing catfish, Ictalurus punctatus (Rafinesque), from fingerlings to marketable size, and to develop the basic techniques necessary for the extension of the culture. This paper presents the developments obtained in the study. Experiments on effects of stocking density per volume of cage, cage mesh size on production are discussed. Observations on feeding behavior, feeding enclosures, feed efficiency, cage materials, cage covers, parasites and disease and other aspects of cage culture are discussed to a limited extent. (From auth.)

14324. Olmsted, Larry and Raj V. Kilambi (Univ. of Ark., Dept. of Zool., Fayetteville, Arkansas). 1970. STOMACH CONTENT ANALYSIS OF WHITE BASS (Roccus chrysops) IN BEAVER RESERVOIR, ARKANSAS. Proc. of the 23rd Ann. Conf. Stheast Assoc. Game and Fish Commrs, Oct. 19-22, 1969, pp. 244-251.

Qualitative and quantitative analyses of stomach contents of 263 white bass (Roccus chrysops) taken from Beaver Reservoir and its tributaries between February 1, 1969 and June 30, 1969 are reported. Fish are classified as pre, mid, and post-spawners based on their migrations into and out of the spawning areas. Stomach contents of white bass are enumerated by frequency occurrence, volumetric and gravimetric methods. Significant differences in the food habits were found between the different periods. (Authors)

14325. Avault, James W., Jr., Charles L. Birdsong, and W. Guthrie Perry, Jr. (School of Forestry & Wildl. Mgmt., La. State Univ., Baton Rouge, Louisiana). 1970. GROWTH, SURVIVAL, FOOD HABITS, AND SEXUAL DEVELOPMENT OF CROAKER, Micropogon undulatus, IN BRACKISH WATER PONDS. Proc. of the 23rd Ann.Conf. Stheast Assoc. Game and Fish Commrs, Oct. 19-22, 1969, pp. 251-255.

Croaker, Micropogon undulatus, were stocked in 6 ponds in 1966 and again in 6 ponds in 1968 to determine general desirability for pond culture in brackish water. Growth and survival was low both years. In the fall, when ponds were drained, fish were about one year old; both males and females were ripe. Stomach analyses revealed that croaker preferred grass shrimp, Palaemonetes sp. (78.4 percent occurrence) to fish (13.3 percent occurrence). The condition index, using total length, was 1.36, while the length-weight relationship was log W = 5.2498 + (3.1652) (log L). (Authors)

14326. Tatum, Walter M., and Peter A. Hackney (Ala. Dept. of Conserv., Game and Fish Div., Montgomery, Alabama). 1970. AGE AND GROWTH OF RIVER REDHORSE, Moxostoma carinatum (Cope) FROM THE CAHABA RIVER, ALABAMA. Proc. of the 23rd Ann. Conf. Stheast Assoc. Game and Fish Commrs, Oct. 19-22, 1969, pp. 255-261.

The river redhorse, Moxostoma carinatum (Cope), is a Catostomid fish of east-central North America. In rivers where it is common, the river redhorse frequently affords a sport fishery, especially during its spawning period. During the period July, 1966, to July, 1968, 339 river redhorse were collected from the Cahaba River, Alabama. Scales from 183 of these specimens were aged and back calculated. An additional 52 pond-reared specimens were utilized for scalation and length-weight studies. Length-weight equations were computed. Female river redhorse were significantly heavier than males throughout the data ranges studied. Male river redhorse from the Cahaba River were greater in length at age groups I, II, III, and IV than were females. Specimens from the Duck River, Tennessee, grew more slowly than those from the Cahaba River although larger sizes were reached in Duck River. (Authors)

14327. Yellayi, Rama R., and Raj V. Kilambi (Dept. of Zool., Univ. of Arkansas, Fayetteville, Arkansas). 1970. OBSERVATIONS ON EARLY DEVELOPMENT OF WHITE BASS, Roccus chrysops (Rafinesque). Proc. of the 23rd Ann. Conf. Stheast Assoc. Game and Fish Commrs, Oct. 19-22, 1969, pp. 261-265.

Very little published information is available regarding the development of white bass with the exception of those described from Lake Texoma. This study describes certain developmental stages of white bass by culturing the eggs obtained from ripe adults. (From authors introduction)

14328. Chervinski, J. (Fish Culture Research Sta., Dor, Israel). 1971. SEXUAL DIMORPHISM IN Tilapia aurea AND Tilapia zillii FROM DOR AND FROM LAKE TIBERIAS. Bamidgeh, 23(2): 56-59.

14329. Shannon, Eugene H. (Div. of Inland Fish., No. Carolina Wildl. Resources Comm., Raleigh, No. Carolina). 1970. EFFECT OF TEMPERATURE CHANGES UPON DEVELOPING STRIPED BASS EGGS AND FRY. Proc. of the 23rd. Ann. Conf. Stheast Assoc. Game and Fish Commrs, Oct. 19-22, 1969, pp. 265-274.

A comparison study was made to determine the effects of temperature upon the percent hatch of striped bass eggs and upon fry survival. No significant difference for percent hatch was found at incubation temperatures between 60°F. and 75°F. at 5° increments. Temperature shock between 65°F. and higher temperatures appears to have a more deleterious effect on freshly fertilized eggs than eggs incubated for 16 or 44 hours at 65°F. before transfer to the same higher test temperatures. Fry produced at 65°F. and transferred to the various test temperatures two days after hatching showed an apparent difference in survival as temperatures exceeded 65°F. A significant difference in fry survival was observed only for those eggs hatched at the various test temperatures and then exposed to 80°F. temperature. (Auth.)

14330. Bingham, C. Rex (Mississippi Game and Fish Commission). 1970. COMPARISON OF INSECTICIDE RESIDUES FROM TWO MISSISSIPPI OXBOW LAKES. Proc. of the 23rd. Ann. Conf. Stheast Assoc. Game and Fish Commrs, Oct. 19-22, 1969, pp. 275-280.

Monthly insecticide tests on waters from two Yazoo-Mississippi Delta Oxbow Lakes show DDT levels to be highest in winter and spring months. Comparison of insecticide levels in Wolf Lake and Mossy Lake waters, muds, and fish flesh show consistently higher levels in Wolf Lake. Thirty-six hour bluegill bioassays in endrin show TLm value of Wolf Lake fish twenty fold greater than Mossy Lake fish. Two hundred thousand largemouth bass (Micropterus salmoides) fingerlings placed in Wolf Lake May 16-25, 1968 showed no survival upon repeated checks with 1/4" mesh seine, electrical fish shocker, and two one-acre population studies. Monthly comparisons of pH, D. O., Free CO_2, total hardness, methyl orange alkalinity, nitrate nitrogen, ortho-phosphate, plankton counts, and benthic samples failed to account for the decline in carnivorous fish species in Wolf Lake and the inability to re-establish a largemouth bass population. Modern farm practices and drainage patterns, which make a virtual agricultural sump of many Yazoo-Mississippi Delta Lakes, have made them void of fish at the top of the food chain and prevents re-establishment of largemouth bass populations. (Auth.)

14331. Blanz, Robert E., Carl E. Hoffman, Raj V. Kilambi, and Charles R. Liston (Dept. of Zool., Univ. of Ark., Fayetteville, Arkansas). 1970. BENTHIC MACROINVERTEBRATES IN COLD TAILWATERS AND NATURAL STREAMS IN THE STATE OF ARKANSAS. Proc. of the 23rd. Ann. Conf. Stheast Assoc. Game and Fish Commrs, Oct. 19-22, 1969, pp. 281-292.

The results of a 1965-66 study of the physico-chemical factors, benthic macroinvertebrates, plankton, and fishes of three cold tailwaters (Bull Shoals, Norfork and Beaver) were published in the Proceedings of the Annual Conference of the Southeastern Association of Game and Fish Commissioners by Brown, Liston, and Dennie (1967). The data presented here are an extension of this work and compare the macroinvertebrates of two natural streams (Buffalo and Kings rivers), two old tailwaters (Bull Shoals and Norfork), and a new tailwater (Beaver, impounded in 1963). The dominant groups of benthic macroinvertebrates in the older tailwaters, Bull Shoals and Norfork, were Isopoda, Chironomidae, Amphipoda, and Oligochaeta. The 1967-68 data show that the Beaver Tailwater just below the dam had fewer organisms per square foot than comparable stations below the older Bull Shoals and Norfork tailwaters and the same stations on the Beaver tailwater during the 1965-66 study. The data also indicate that Chironomidae have become relatively more abundant at all stations in the Beaver tailwater since the earlier study. Isopoda have increased at the first station below Beaver Dam while Oligochaeta decreased at all stations. Trichoptera, Coleoptera, Ephemeroptera, and Gastropoda were abundant in one or both natural streams. The Coleoptera dominated the Buffalo River samples and Ephemeroptera and Trichoptera were most abundant in the Kings River. (Authors)

14332. Buchanan, Thomas M. and Kirk Strawn (Dept. of Zool., Univ. of Texas, Austin, Texas). 1970. A FIELD TEST OF THE USE OF SCALE SIZE AT THE FORMATION OF THE FIRST ANNULUS TO PERMANENTLY MASS-MARK SMALLMOUTH BASS, Micropterus dolomieui Lacépède. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 303-311.

This study, using smallmouth bass, Micropterus dolomieui Lacépède, was a field test of a new method of permanently mass-marking fishes. This method consists of producing fish by means of rapid or prolonged growth whose scales have a significantly larger focus to first annulus distance than fish native to a stream chosen for stocking. In October, 1965, 322 young-of-the-year bass, that had been raised either in laboratory aquaria or a hatchery pond, were stocked in three headwater streams of Northwest Arkansas. Recapture attempts in June, 1966, yielded seven scale-marked bass from two of the three streams stocked, indicating the feasibility of this marking technique for certain types of field use. (Authors)

14333. Buntz, Jon and Charles S. Manooch, III (Fla. Game and Fresh Water Fish Comm., Lakeland, Florida). 1970. FISHERMAN UTILIZATION OF Tilapia aurea (Steindachner) IN LAKE PARKER, LAKELAND, FLORIDA). Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 312-319.

Tilapia aurea, blue tilapia (Smith-Vaniz, 1968) were brought to Florida in 1961. Verification of this species in Lake Parker occurred five years later. Since this time, they have reached a concentration which provides a unique fishery. Parker, a 2,291 acre lake located in Lakeland, Florida, was creeled for a year to determine fisherman utilization of blue tilapia. Harvest by baited hook was significant only three months of the period. This species comprised over 40 percent of the total harvest six months of the year, after legalization of cast netting and snatch hooking. Success by these methods was correlated with two, seasonal factors; spring spawning activity and warm water outflow from an electrical power plant in winter months. This does not indicate that Tilapia aurea is an additional sport fishery, but rather a food fish that can be significantly harvested only by special methods. (Authors)

14334. Allen, Kenneth O. and James W. Avault, Jr. (School of Forestry and Wildlife Management, La. State Univ., Baton Rouge, Louisiana). 1970. EFFECTS OF SALINITY ON GROWTH AND SURVIVAL OF CHANNEL CATFISH, Ictalurus punctatus. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 319-331.

Laboratory tests were conducted to determine the effect of salinity on growth and survival of channel catfish, Ictalurus punctatus. Three-day old or older eggs tolerated up to 16 ppt total salinity. However, at the time of hatching there was a sharp drop in tolerance to about 8 ppt. This level of tolerance was maintained during the period of yolk absorption. Following yolk absorption there was an increase in tolerance to about 9 or 10 ppt. By five months of age tolerance had increased to 11 ppt and to 12 ppt by six months. The level of tolerance was about the same at 11-14 months. Nine days acclimation to 5 ppt increased growth and food conversion slightly but did not increase survival. Forty days of acclimation to 5 ppt increased tolerance about 0.5 ppt. Fish failed to maintain themselves at salinities greater than 12 ppt, even with extended acclimation to 10 ppt salinity. In long-term studies, starting at an age of 42 days and continuing through an age of 148 days, fingerlings in freshwater had the best indexes for food consumption, growth, food conversion and survival. Fingerlings in 5 ppt salinity did almost as well. Fingerlings in 10 ppt salinity were a poor third. In long-term studies with 11 through 14 month-old yearlings, when fish were acclimated to 5 ppt, indexes were similar at all test salinities of 0 ppt through 11 ppt. Fish acclimated to 10 ppt gave similar results at 0 ppt through 12 ppt. (Authors)

14335. Wolf, Ken (Eastern Fish Disease Lab., Kearneysville, West Virginia). 1971 SOFT-EGG DISEASE OF FISHES. U. S. Dept. of the Interior, Bur. of Sport Fish. & Wildl., Division of Fishery Research, Fishery Leaflet 34, formerly Fishery Leaflet 457.

14336. Roland, John V., and Kenneth B. Cumming (Coop. Fish. Unit, Va. Polytechnic Inst., Blacksburg, Virginia). 1970. THE EFFECT OF WATER QUALITY ALTERATION ON THE GROWTH RATE OF WHITE SUCKER. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 332-352.

The introduction of Tinker Creek water in November, 1966 changed Carvin Cove Reservoir from a soft water lake to a medium-hard water lake by the end of 1968. Tinker Creek was found to be extremely high in dissolved nutrients, resulting in much higher pH, alkalinity and hardness values than were found in the other major streams entering the reservoir. Water quality in different areas of the lake in 1968 was changed somewhat as a result of the hard water flowing into the reservoir from Tinker Creek. Dissolved nutrients were denied access to the hypolimnion during the summer months, and pH, alkalinity and hardness were generally higher in the area near the Tinker Creek inflow. Bottom fauna was found in higher concentrations in the area of the reservoir close to the hard water inflow. High concentrations of fish were found in the vicinity of the Tinker Creek inflow. Gizzard shad and white suckers seemed to be more abundant in this area. Growth rates in the white sucker increased significantly after Tinker Creek water was added. (Authors summ. and conclusions)

14337. Warrinner, J. E., J. P. Miller, and J. Davis (Va. Inst. of Marine Sci., Gloucester Point, Virginia). 1970. DISTRIBUTION OF JUVENILE RIVER HERRING IN THE POTOMAC RIVER. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 384-388.

14338. Broach, Richard W. (Arkansas Game and Fish Comm., Little Rock, Arkansas). 1970. A MANAGEMENT SURVEY OF PUBLIC FISHING IN DELTA REGIONS OF EASTERN ARKANSAS. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 388-397.

Intensive agricultural endeavor and accompanying environmental degradation have virtually eliminated the native fishery of eastern Arkansas' delta regions. Unsatisfied public demands for outdoor recreation have, of course, increased as corresponding opportunities have been reduced. The fisheries management biologist in eastern Arkansas is faced with a multitude of perplexing management problems which in many respects are unique to the heavily farmed regions of southeastern United States. Managed lakes and impoundments in northeast Arkansas will fall, generally, into one of three categories or classifications: 1) Ridge or foothill impoundment which receive surface runoff from a primarily timbered or pastured watershed (little or no row crop farming in the watershed). The soils of the watersheds of these lakes fall within the Loessial Hills Association and, to a lesser extent, the Ozark Highlands Association. 2) Oxbow or overflow lakes which receive surface runoff from an intensively farmed watershed. (Soils fall within the Loessial Terraces or Bottomlands and Terraces Associations). 3) Floodplain impoundments which are designed for absolute topographic isolation from the watershed and must be maintained by pumping or water gate manipulation. (Soils are similar to those of Class 2 lakes.) Empirically determined management procedures as applied in distinct situations for maximum benefits to public recreational opportunities are reviewed in detail. (Auth.)

14339. Swingle, Hugh A. (Ala. Marine Resources Lab., Dauphin Island, Alabama). 1970. PRODUCTION OF THE THREADFIN SHAD, Dorosoma petenense (Günther). Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 407-421.

Adult threadfin shad, Dorosoma petenense (Gunther), were stocked alone in ponds at rates from 100 to 1,600 per acre to determine the most efficient rate of stocking for maximum production. Total production varied from 84.5 to 290.0 pounds per acre while net production ranged from 36.4 to 169.0 pounds per acre. The number of young per surviving parent varied from 1,392 at a stocking rate of 100 adults per acre to 82 young at a stocking rate of 1,600 adults per acre. Threadfin shad stocked in April spawned from May (76°F) through August. The

net production of threadfin and gizzard shad, Dorosoma cepedianum (LeSueur) stocked at 200 per acre was 70.0 and 85.5 pounds per acre, respectively. Gizzard shad spawned 2 months before the threadfin and both species grew at the same rate. Threadfin shad stocked together with other species gave varying results. Young-of-the-year shad were completely eliminated in one pond containing largemouth bass, Micropterus salmoides (Lacépède), and bluegill, Lepomis macrochirus Rafinesque. (Auth.)

14340. Kolehmainen, Seppo E. (Radiation Ecology Section, Oak Ridge National Lab., Oak Ridge, Tennessee). 1970. DAILY FEEDING RATES OF BLUEGILL DETERMINED BY A RADIOISOTOPIC METHOD. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 422-430.

14341. Corning, Raymond V. (Va. Comm. of Game and Inland Fish., Richmond, Virginia). 1970. WATER FLUCTUATION, A DETRIMENTAL INFLUENCE ON TROUT STREAMS. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 431-454, illus.

Stream fluctuations strongly influenced the biotic populations of three Colorado trout streams during a three year water quality study conducted on the streams. Extreme water fluctuations (94% variation in surface area), combined with stream bedload accumulations, reduced a productive trout water to a non-productive series of intermittent pools during the course of the study. One study station produced the highest consistent production of benthos and the largest standing crops of trout in numbers. According to weight, however, the same station produced the fourth largest standing crops of trout. The discrepancy was attributed primarily to adverse feeding conditions for trout; a result of stream flow reductions during summer months. Rapid reductions in stream flow produced an abnormal concentration of benthos at another station, followed by a rapid decline in the benthos population within a two week period. Unusual oxygen deficits were recorded in one instance, with oxygen levels lowest during photosynthetic periods and highest during periods of darkness. Oxygen concentration deficits were traced to two factors, decomposing cow manure in the stream and low stream flow. Egg survival studies pointed out the other adverse effects of stream fluctuation. Artificial redds and baskets containing rainbow trout eggs were placed in stream gravels of 2 of the 3 study streams High stream flows at one station, due to a sudden release of water from an upstream reservoir, disinterred 75% of the buried eggs. Viability of the remaining eggs appeared to be lowered. Sharply declining water levels at a lower station on the same stream left all of the artificial trout redds and baskets free of water 1 or 2 days prior to fry emergence; after the eggs had withstood flood conditions. Cessation of water releases from the same reservoir that produced flood conditions caused the decline in water levels. At a third station located on a different stream, eggs were also exposed to air when the stream level receded. This time, water recession was due to natural rather than man caused conditions. The only vascular plant common to all three drainages was Veronica americana. Veronica was found on moist ground, sand bars and emersed, seemingly well adapted for areas of extreme water fluctuation. Other macroscopic aquatic plants were common only in George Creek, the stream with the most stabilized stream flow. (Auth.)

14342. Greene, George N. (Auburn Univ. Agric. Exp. Sta., Auburn, Alabama). 1970. EFFECTS OF WATER HARDNESS ON FISH PRODUCTION IN PLASTIC POOLS. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 455-461.

The presence of Cecil soil in the pools had no significant effect on fish production. Magnesium hardness had no measurable effect on fish production. The increased hardness resulting from the addition of $CaSO_4$ increased fish production. The increase in hardness due to addition of $CaCO_3$ appeared to decrease fish production. The different effects with $CaSO_4$ and $CaCO_3$ may be due to the effects of sulfate and carbonate. (Auth. conclusions)

14343. Hooper, Gerald R. (Ala. Dept. of Conserv., Div. of Game and Fish, Montgomery, Alabama). 1970. RESULTS OF STOCKING LARGEMOUTH BASS, BLUEGILL, AND REDEAR SUNFISH IN PONDS LESS THAN 0.25 ACRE. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 474-479.

A study was undertaken during the period of 1962-65 to determine the minimum acreage of water which can produce and sustain a balanced largemouth bass, Micropterus salmoides (Lacépède), bluegill, Lepomis macrochirus Rafinesque, and redear sunfish, Lepomis microlophus (Günther), population. Thirty-three ponds ranging from 0.17 to 0.25 acre and which contained no fish were selected in North Alabama during 1962-63. The ponds were stocked by the State Fish Hatchery during the 1962-63 season. Suggestions that would aid in the management of a pond to obtain the maximum production of fish were offered to each pond owner. Balance checks were conducted on these ponds during the first and second year of fishing. These checks on 30 usable ponds the first year indicated that 16 ponds contained a balanced fish population. Seven ponds contained a crowded bluegill population, and 7 ponds were crowded by competitive species. Checks on 29 usable ponds the second year indicated that 7 ponds contained a balanced fish population. Fourteen ponds contained a crowded bluegill population, and 8 ponds were crowded by competitive species. The low percentage of ponds that maintained a balanced fish population indicated that it is not feasible to stock ponds that are smaller than 0.25 acre with a largemouth bass, bluegill, and redear sunfish combination. (Auth.)

14344. Prather, E. E. (Auburn Univ. Agric. Exp. Sta., Auburn, Alabama). 1970. FISHING SUCCESS FOR CHANNEL CATFISH AND WHITE CATFISH IN PONDS WITH DAILY FEEDING. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 480-490.

Channel and white catfish fingerlings, stocked in ponds with largemouth bass at densities of 2,000 to 3,000 catfish per acre separately or in combination and given daily feeding have continued to provide excellent sport fishing. Four-inch fingerling catfish stocked by February and given supplemental feeding at rates of 2 to 3 percent body weight daily reached harvestable size of 0.7 lb. by October at which time the ponds were opened to fishing. Harvest by fishermen in ponds stocked with 2,000 catfish per acre ranged up to 1,292 pounds catfish per acre during a 12-month period following initial opening. When 7-11 inch channel catfish fingerlings were stocked by February at the rate of 3,000 per acre, along with largemouth bass, the catfish reached 0.7 pound average weight by August. During the periods August 1 to October 25 and March 15 to September 7, 1,096 fishermen caught 2,655 pounds catfish per acre. Agitators run in ponds from spring to fall increased oxygen concentrations and allowed heavier stocking densities and feeding rates without any fish kills. In one pond where 5,000 catfish fingerlings were stocked per acre and given daily feeding the catch reached 2,938 pounds catfish per acre in a 12-month period of fishing. (Auth.)

14345. O'Rear, Robert Stephen. 1970. A GROWTH STUDY OF REDBREAST, Lepomis auritus (Günther), AND BLUEGILL, Lepomis macrochirus (Rafinesque), POPULATIONS IN A THERMALLY INFLUENCED LAKE. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 545-553.

Bluegill and redbreast populations were sampled by electric shocking techniques from two normal areas and an area affected by the heated discharge of a power generation plant at Lake Sinclair, Georgia. Growth of the fish was derived by the Lea method from measurements of the distance between the last formed annulus to the edge of the scale. By comparison of the study areas, temperature was found not to be the controlling factor of bluegill and redbreast growth in the discharge area. (Auth.)

14346. Collins, Richard A. (State Coll. of Arkansas, Conway, Arkansas). 1970. THE EFFECTS OF INORGANIC FERTILIZERS AND ORGANIC MATTER UPON THE PRODUCTION OF MACROBENTHOS IN PONDS. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 397-406.

14347. Klussmann, W. G., M. A. Champ, and J. T. Lock (Texas A&M Univ. Agric. Ext. Service, College Station, Texas). 1970. UTILIZATION OF ANHYDROUS AMMONIA IN FISHERIES MANAGEMENT. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 512-520.

This study completes a segment of a project to evaluate the use of anhydrous ammonia as a fisheries management technique in small impoundments. Objectives were to determine the feasibility of using anhydrous ammonia for fish eradication, for pond fertilization, and for vegetation control. Treatments in 15 pounds in Central Texas indicate that anhydrous ammonia fulfills these objectives. Anhydrous ammonia was selected because of known toxicity to fishes and because ammonia is a naturally occurring compound. Thus, the use of anhydrous ammonia as a total or selective population control agent will not leave a persistent nondegradable residue in a pond. Treatment rates varied from 13 to 40 ppm of anhydrous ammonia. Higher treatment rates caused total kills while lower treatment rates appeared selective for certain species. Phytoplankton and zooplankton populations were decimated and recovered slowly. As expected, profound changes in ammonia, pH, CO_2, and alkalinity occurred following treatments. (Authors)

14348. Smith, William B. (Div. of Inland Fish., N. C. Wildl. Resources Comm., Raleigh, North Carolina). 1970. A PRELIMINARY REPORT ON THE BIOLOGY OF THE ROANOKE BASS, Ambloplites cavifrons Cope, IN NORTH CAROLINA. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 491-500, illus.

14349. Keith, William E. (Ark. Game and Fish Comm., Little Rock, Arkansas). 1970. PRELIMINARY RESULTS IN THE USE OF A NURSERY POND AS A TOOL IN FISHERY MANAGEMENT. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 501-511, illus.

14350. Allen, George W. 1970. POOL FLUCTUATION IN CORPS IMPOUNDMENTS IN RELATION TO FISH SPAWNING. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 553-558.

Each spring and early summer the Corps of Engineers and the associated conservation agencies of the various states work together to program and operate the Corps' reservoir levels so that a minimal alteration of environment will occur during the spawning period of game fish in these reservoirs. The demands of flood control, navigation, hydro-electric power and fisheries resources must be coordinated to produce a condition in which these varied interests are working together to produce the required results to the benefit of all. Communications between all involved agencies during the time of gamefish spawning, and notification of operational procedures is the major contributor to failure or success at this time. Public awareness of the problems involved as well as the action being taken by all agencies decreases the usual rash of complaints against both the conservation agencies and the Corps of Engineers. In spite of coordinated efforts, this reservoir level manipulation has not been proven to have either a beneficial or detrimental effect on the fisheries resources. In areas where such activities have taken place desirable fish populations have continued to increase and maintain high populations. This correlation between the fish populations and intensive water level management is such however, that it will be continued until proven to have no effect. The high fishing effort-catch ratio is such that it would not be prudent to alter the present system of management and in any way jeopardize the success of the fishermen utilizing these areas. (Auth.)

14351. Jarman, Ron, and Jack L. Harper. 1970. PRODUCTION OF STRIPED BASS FINGERLINGS, Morone saxatilis (Walbaum), ON OKLAHOMA STATE FISH HATCHERIES. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 571-575.

Experimental culture of striped bass in Oklahoma State Fish Hatcheries was initiated in 1965. This work has resulted in several procedural guidelines which will enable the successful production of striped bass. The application of these guidelines to production on Oklahoma's antiquated State Fish Hatchery System is discussed. Factors which have influenced the application of desired

methods on three State fish hatcheries are: Availability of sufficient water; fertility of ponds; aquatic vegetation; availability of equipment and supplies; quality of hatchery personnel; climate; amount and suitability of harvest equipment. These factors are discussed in relation to the 1969 rearing season. (Authors)

14352. Wollitz, Robert E., and John H. Jesse. 1970. NOTES ON THE TROUT FISHERY OF HIDDEN VALLEY LAKE, A COLD WATER IMPOUNDMENT, IN SOUTHWEST VIRGINIA. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 576-586.

Hidden Valley Lake is an acid water, shallow trout impoundment located in southwest Virginia at an elevation of approximately 3,600 feet above sea level. Renovation of the dam and outlet structures and fish management procedures are discussed. Subsurface water temperatures and dissolved oxygen values were obtained during the summers of 1965 and 1966. These are discussed in relation to an aeration system installed during the fall of 1965. No definite conclusions concerning beneficial effects on the fishery were arrived at; although dissolved oxygen in bottom waters was higher during the summer in which the aeration system was in operation. The aeration did appear to be effective in removing ice from around the outlet tower. Rainbow trout, Salmo gairdneri, brook trout, Salvelinus fontinalis brown trout, Salmo trutta were introduced into the lake. Brook trout appeared to achieve a better growth rate than either of the other two species. Evidence of reproduction was found only for the brook trout. Creel information indicated the brook trout to be more readily taken than either the rainbow or brown trout, as is shown by the increase in rate of harvest in 1968 when brook trout entered the creel in significant numbers. Trophy size trout were taken occasionally. Rainbow 19-inches in total length and brown trout 21-inches in total length have been reported caught. (Authors)

14353. Surber, Eugene W. (Va. Comm. of Game and Inland Fisheries, Browntown, Virginia). 1970. PROCEDURE IN TAKING STREAM BOTTOM SAMPLES WITH THE STREAM SQUARE FOOT BOTTOM SAMPLER. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 587-591.

A detailed description of the procedure used in taking stream bottom samples follows a description of the stream square foot bottom sampler, which, although pictured in a publication by the author in 1937, was not described in detail in any publication. One of the principal problems in retrieving bottom animals from samples is getting them quickly from the gravel without damaging them. Large stones in the sample area are removed first and placed in a pail half-filled with water. The contents of the net are also emptied carefully into the same pail. Upon reaching the shore, the pail is filled with water. After washing and removal of the large stones which are placed where animals crawling from hiding places on them can be retrieved, a series of decantations are made into a U. S. Series No. 30 soil sieve 8 inches in diameter and 2 inches deep held in water above the screen surface. After this decantation process, the gravel and sand are placed in a white enamel photographic tray from which any molluscs present are removed. The few bottom animals that escape the decantation process are retrieved at this time. Animals and debris retained by the sieve are concentrated by a swirling action of the sieve and placed in pint jars. In the laboratory, the samples (after washing to remove formalin) are placed in large white trays, the bottoms of which have been divided into approximately 50 x 30 m.m. rectangles with a diamond point glass-marking pencil. The surface scratches are filled with India ink. Black, hard-rubber trays are used for the retrieval of animals in samples containing small oligochaete worms. Petri dishes about 100 m.m. in diameter are used for the systematic placement of bottom organisms within concentric circles spaced about 12 m.m. apart. The contents of the petri dishes are examined on the raised stage of a binocular microscope. (Auth.)

14354. Perry, W. Guthrie, Jr., and James W. Avault, Jr. (La. Wild Life and Fisheries Comm., Grand Chenier, Louisiana). 1970. CULTURE OF BLUE, CHANNEL AND WHITE CATFISH IN BRACKISH WATER PONDS. Proc. of the 23rd Ann. Conf. Stheast. Assoc. of Game and Fish Commrs, Oct. 19-22, 1969, pp. 592-605.

Brackish water pond studies were conducted in coastal Southwest Louisiana with blue, Ictalurus furcatus, channel, Ictalurus punctatus, and white catfish, Ictalurus catus, to determine if these freshwater species could be cultured in saline ponds. The channel and white catfish proved to be the most rapid growing and the most hardy, averaging 0.80 and 0.70 pounds. The blue catfish averaged 0.6 pound. The channel catfish had the lowest S-value of 2.3, the white catfish had a S-value of 2.9 and the blue catfish had a S-value of 4.0. Survival was the highest for channel catfish, 91 percent, and lowest for the blue catfish, 69.6 percent. The condition indexes, using standard length, calculated for the white, channel and blue catfish were 2.15, 1.70 and 1.49, respectively. Blue and channel catfish collected from surrounding waters had K values slightly less. Length-weight relationships were calculated for the pond reared blue, channel and white catfish and were compared to that calculated for wild blue and channel catfish collected from the refuge. The length-weight relationships for the pond reared channel catfish was Log W = -5.530 + 3.196 Log L, blue catfish was Log W = -7.566 + 3.985 Log L, and the white catfish was Log W = -5.487 + 3.237 Log L. The R^2 values were 0.998, 0.999 and 0.995, respectively. (Authors)

14355. Caillouet, Charles W. (Rosenstiel School of Marine and Atmospheric Sci., Univ. of Miami, Miami, Florida). 1970. COMMERCIAL AND RECREATIONAL FISHERY RESOURCES OF ESTUARINE WATERS, SOUTHERN UNITED STATES. Reprint from Hydrobiology "Bioresources of Shallow Water Environments", Proceedings Series No. 8, pp. 44-50.

The paper examines briefly the relationship between the most important commercial and sport fishery resources and the estuarine environment of the Gulf coastal states, including Texas, Louisiana, Mississippi, Alabama, and Florida. (Auth.)

14356. Brownell, Willard N., and William E. Rainey. 1971. SPECIAL REPORT. RESEARCH AND DEVELOPMENT OF DEEP WATER COMMERCIAL AND SPORT FISHERIES AROUND THE VIRGIN ISLANDS PLATEAU. Contribution No. 3, Virgin Islands Ecological Research Station, Caribbean Research Institute, 88 p.

Results of 15 months of exploratory fishing around the Virgin Islands (and complementary data from neighboring islands) are presented. Stocks of snapper and grouper of some value to local commercial and sport fisheries have been found in deep water at the shelf edges. Means for more effective and managed exploitation of these species are discussed, as well as the financial bases and shore support operations needed. Ecological information presented for the species caught includes geographical and depth distribution, ciguatera poisoning, and feeding habits. Development efforts and activities of the fishermen's associations in the Virgin Islands during the past year are discussed. (Authors)

14357. Gunning, Gerald E. (Tulane Univ., New Orleans, Louisiana). 1971. FISHES, OUR CHANGING ENVIRONMENT AND THE CONTEMPORARY FISHERY SCIENTIST. BioScience, 21(22): 1115-1120, illus.

This article is an exposition of what has been accomplished during the past year, as seen in some of the papers appearing in Volume 99 of the Transactions of the American Fisheries Society; coverage is, by definition, selective since this volume contains well over 100 scientific papers. Discussed are: Fishery management – Sport fishery applications ---Coho salmon planted in a Lake Superior tributary; Predator reduction and trout management. Fishery management – Commercial applications --- Sea Lamprey in the Great Lakes; Fish production in ponds; Anchovies in the Peru Current. Biological effects of dam construction --- Statement of the problem; Seasonal changes in downstream migration of chinook salmon; Effect of release location on survival of juvenile fall chinook salmon; Passage of fish through turbine intakes of dams; Dissolved nitrogen concentrations and salmon in the Columbia River. Genetics of fishes --- Interspecific and intergeneric sunfish crosses; Analysis of a natural hybrid swarm. Deleterious effects of pesticides and herbicides --- Chronic effects of 2,4-D on the bluegill; Susceptibility of fish family representatives to insecticides.

14358. Winterbourn, M. J., Pamela Alderton, and G. G. Hunter (Zool. Dept. Univ. of Canterbury, New Zealand). 1971. A BIOLOGICAL EVALUATION OF ORGANIC POLLUTION IN THE LOWER WAIMAKARIRI RIVER SYSTEM 1970-71. N. Z. Marine Dept. Fisheries Technical Report No. 67, 69 p.

Effluents from a fellmongery and a milking shed are pollution sources on the North Branch. Fine particulate matter from the former settles on the stream bed and has changed the nature of the substratum. A high proportion of this fine material is confined to a short stretch of stream immediately below the fellmongery where the stream gradient is shallow and the water flow slow. This alteration in the nature of the stream bed has been accompanied by a change in the composition of the fauna which is now dominated by burrowing forms, particularly oligochaete worms and chironomid midge larvae. In addition to changing the nature of the bed, an increased supply of nutrients is added to the stream. This has undoubtedly resulted in an increase in numbers of benthic invertebrates. The lower course of the South Branch is heavily polluted by freezing works effluents which have had a similar effect to those from the fellmongery in the North Branch, smothering the stream bed with soft, particulate matter (much probably originating from stomach contents). This has resulted in similar changes in the composition and abundance of the fauna and a reduction in the oxygen content of the water, particularly at night. The effects of effluent discharges into the South Branch are harmful throughout the length of the stream, and continue well into the main Waimakariri River. Pollution sources in the Northbrook Drain and Cam River were septic tanks, but their effects on the streams were minor. A comparison with the results of Hirsch's 1956-57 survey suggests that the effects of organic pollution are greater now in both the North and South Branches than they were in 1957, but that little change has occurred in the Northbrook Drain or the upper Cam River. A complete clean up of the stream should be possible if no effluents are emptied into them. Failing this, considerable improvement in the North and South Branches could be achieved through greater treatment of wastes before their release. In this study a considerable body of information on the biology of the four Waimakariri tributaries has been accumulated, and this should provide a firm basis for future comparative studies following the introduction of pollution control measures, if and when these are undertaken. In making such a follow-up study it would be desirable to use the same procedures carried out here and to make the study at the same time of year so that changes in fauna brought about by seasonal factors are minimised. (From authors summ. and conclusions)

14359. Cairns, John, Jr., John S. Crossman, Kenneth L. Dickson, and Edwin E. Herricks (Dept. of Biol. and Center for Environ. Studies, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. THE RECOVERY OF DAMAGED STREAMS. Reprint from The ASB Bulletin, 18(3): 79-106.

From the four case 'history studies' presented it appears that the biological recovery of damaged rivers is a function of the physical, chemical, and biological characteristics of the receiving stream, the severity and duration of the stress, and the availability of undamaged areas to serve as sources for recolonizing organisms. Short term acute stresses produced by the release of acidic or caustic materials into a receiving stream elicit a response pattern in the macroinvertebrate and fish communities typified by an immediate reduction in the number of specimens. When no residual toxicity is found and there are undamaged areas available to act as sources for recolonizing organisms a rapid recovery may be expected. Mill Creek had such a recovery when a small (100 foot) section of the creek was experimentally treated with acid immediately below an undamaged headwater area. By comparison the biological recovery of the Clinch River from the acute pH stresses has been somewhat slower due to the severity and the extent of the biological damage. A long term acute stress and stresses from materials with residual toxicities produce a similar but slightly different response pattern. Just as in short term acute stress situations the general response pattern is an immediate reduction in both diversity (number of species) and density. However, with residual toxicities the macroinvertebrate organisms that survive the stress seem to be able to establish an interim type of community structure which lasts as long as the

toxicity persists. For example, the Roanoke River had a residual toxicity from the ethyl benzene - cresote spill which was combined with a sedimentation problem and resulted in an atypical benthic community consisting of snails, midge larvae, mayflies, and stoneflies. This community did not have representatives from the caddis fly, riffle beetle, and crayfish families. The macroinvertebrate community found under continuous acid stress in the Indian Creek study was also atypical consisting primarily of caddis flies and hellgrammites. The rate of recolonization of damaged areas seems to be dependent upon 1) the distance an area is located from the site of the original spill and 2) the existence of undamaged tributaries. Those areas immediately below the site of the Clinch River spills were the first to show recovery. Reaches of the river further downstream were slower to recover. The rate of recovery is also faster below healthy tributaries as shown in the Indian Creek study. (Authors)

14360. Heidinger, Roy C. (Southern Ill. Univ., Carbondale, Illinois). 1971. USE OF ULTRAVIOLET LIGHT TO INCREASE THE AVAILABILITY OF AERIAL INSECTS TO CAGED BLUEGILL SUNFISH. Progr. Fish-Cult., 33(4): 187-192.

Fifteen-watt ultraviolet light bulbs were used in modified Pennsylvania light traps to attract food organisms to bluegill sunfish (Lepomis macrochirus Rafinesque) confined in wire cages. The growth rate as influenced by light trap position (therefore, cage position), pond location, and population density, was investigated. Bluegill sunfish stocked in illuminated cages at rates of 5 to 27 fish per m^3 showed good growth and high survival. A cage illuminated by a 15-W ultraviolet and 25-W incandescent bulb supported 10.4 kg of fish in lowland areas, while a cage at upland areas supported 5.6 kg of fish. Two-fifths of the food organisms entered the cage through the water, and three-fifths entered through the air. During the summer, 187 g of aerial insects were eaten per day by a cage of fish at the lowland area and 100 g of aerial insects per day at the upland areas. It was determined that for maximum efficiency, the light traps should be placed more than 3 but less than 15 m apart. There was no significant difference in the quantity of insects caught by a light trap located 3 m from shore and one 9 m from shore. (Auth.)

14361. Prasher, Janis B., Wilbur M. Tidd, and Richard A. Tubb (Bur. of Sport Fish. and Wildl., Ohio Coop. Fish. Unit, Ohio State Univ., Columbus, Ohio). 1971. TECHNIQUES FOR EXTRACTING AND QUANTITATIVELY STUDYING THE SPORE STAGE OF THE PROTOZOAN PARASITE Myxosoma cerebralis. Progr. Fish-Cult., 33(4): 193-196.

A technique was developed for extracting and concentrating Myxosoma cerebralis spores. This method yielded a high concentration of spores in a suspension relatively free of skeletal debris. Pooling fish further increased spore concentrations, improving the probability of detection in lightly infected fish populations. A technique was also developed for estimating concentrations of spores from infected fish. A statistical analysis conducted on spore counts from two infected fish established that reasonable concentration estimates can be made. Sample fish were examined from three infected rainbow trout populations. Estimations were made on the number of spores carried in each fish. These estimates showed that high numbers of spores can be carried by fish that survive whirling disease infections. It was also found that the degree of infection varied between populations. (Authors)

14362. Stickney, Robert R., and James W. Andrews (Skidaway Inst. of Oceanog., Savannah, Georgia). 1971. THE INFLUENCE OF PHOTOPERIOD ON GROWTH AND FOOD CONVERSION OF CHANNEL CATFISH. Progr. Fish-Cult. 33(4): 204-205.

Two experiments were carried out in aquariums to test the effect of photoperiod on growth of channel catfish (Ictalurus punctatus) fingerlings averaging 5.5 and 23 g. The fish were exposed to photoperiods of 0, 6, 12, 18, and 24 hours for several weeks. In both experiments a more rapid growth rate was noted with a 12-hour photoperiod, although differences among the groups were not statistically significant. Food conversion ratios were slightly improved at 12 hours photoperiod. These results indicate that controlled photoperiod has little effect on the production of catfish. (Authors)

14363. Andrews, James W., Lee H. Knight, Jimmy W. Page, Yoshiaki Matsuda, and E. Evan Brown (Skidaway Inst. of Oceanog., Savannah, Georgia). 1971. INTERACTIONS OF STOCKING DENSITY AND WATER TURNOVER ON GROWTH AND FOOD CONVERSION OF CHANNEL CATFISH REARED IN INTENSIVELY STOCKED TANKS. Progr. Fish-Cult., 33(4): 197-203.

In an attempt to gain information on the water and stocking density requirements for high density culture (tank or raceway) of channel catfish (Ictalurus punctatus), fingerlings averaging 20 g each were reared for 6 months in 18, 8-foot diameter fiberglass fish culture tanks. A duplicated 3 x 3 factorial design with three stocking rates (2, 4, and 6 fish per cubic foot of water) and three water exchange rates (2.5, 6, and 12 hours per turnover) was utilized. In the groups with the best conditions, fish were reared to an average weight of 343 g. Stocking density and water turnover both had substantial effects on growth and food conversion. Reduced growth due to an increase in stocking density was largely compensated for by increased water exchange. The fact that excellent performance (high growth and survival rate and low food conversion) was obtained in relatively poor environmental conditions (compared to trout or salmon requirements) indicated that catfish may be ideal for high density culture in tanks or raceways. (Authors)

14364. Rowe-Rowe, D. T. (Natal Parks Board, Pietermaritzburg, Natal, South Africa). 1971. ROTENONE TOLERANCES OF SOME FRESHWATER FISHES OF NATAL. Progr. Fish-Cult., 33(4): 206-209.

Rotenone tolerances, expressed as LC_{50}, were reported for nine species of freshwater fishes. Tolerances of tested species varied from 0.0016 to 0.0516. In one species, there was a lower tolerance in juvenile specimens than in adult ones. In another species, the reaction of eggs, alevins, and fry was compared. (Auth.)

14365. Carlson, Jack (Glenwood Hatchery, N. M. Dept. of Game and Fish, Glenwood, New Mexico). 1971. A HATCHERY TROUGH CLEANER. Progr. Fish-Cult., 33(4): p. 209.

A new trough cleaner that saves time and labor is described. This device saves 7-1/2 min per hatchery trough per day. (Auth.)

14366. Jensen, Alvin L., and Richard N. Duncan (Bur. of Comm. Fish. Biol. Lab., Seattle, Washington). 1971. HOMING OF TRANSPLANTED COHO SALMON. Progr. Fish-Cult., 33(4): 216-218.

Hatchery-raised coho salmon (Oncorhynchus kisutch) smolts were transplanted from Leavenworth National Fish Hatchery to Ice Harbor Dam and held in spring water for 36 to 48 hours before being released. Both jacks and adults selected the spring as a homing site on their spawning migration, even though it was not on the tributary where they had been raised. (Authors)

14367. Robinson, John B. (Calif. Dept. of Fish and Game, Sacramento, California). 1971. EFFECTS OF PASSING JUVENILE KING SALMON THROUGH A PUMP. Progr. Fish-Cult., 33(4): 219-223.

King salmon (Oncorhynchus tshawytscha) fingerlings were passed through a volute pump to determine if this would be a satisfactory way to bypass such fish from fish screens back to the stream from which they were diverted. There was no significant difference in the number of mortalities of salmon fingerlings passed through the pump at different revolutions per minute and elevations. However, the difference between the number of mortalities of pumped fish and control fish was significant. At the termination of the experiment, 4.1% of the test fish and 1.4% of the control fish had died. The loss attributable to pumping is the difference between these two or 2.7%. It appears that injury and mortality due to the pump were minor. (Auth.)

14368. Wolf, Robert S. (NMFS, Exploratory Fishing and Gear Research Base, Woods Hole, Massachusetts). 1971. RESEARCH VESSELS OF THE NATIONAL MARINE FISHERIES SERVICE. U. S. Dept. of Commerce NOAA Technical Report NMFS Circ-362, 46 p., illus.

14369. Liao, Paul B. (Kramer, Chin and Mayo, Consulting Engineers, Seattle, Washington). 1971. WATER REQUIREMENTS OF SALMONIDS. Progr. Fish-Cult., 33(4): 210-215.

One of the most important requirements for a salmonid fish hatchery is the water supply. A modern, efficient hatchery is impossible to design if the rate of water supply for fish propagation is unknown. Various factors affecting the water requirements of salmonids and various methods of determining the amount of water required are discussed. In general, the water requirements for propagation of salmonids can be determined by using the following formulas:

$$O_2 = KT^nW^m$$

$$C_e = \frac{S \times 132}{T^{0.625}} \times \frac{760}{760 + \frac{E}{32.8}}$$

$$Q = \frac{1.2\,(C_e - C)}{O_2}$$

where O_2 = oxygen uptake rate in lbs O_2/100 lbs fish/day; T = water temperature in degrees Fahrenheit; W = fish size in lb/fish; K = rate constant; m, n = slopes. The values of K, m, and n for salmon and trout at various water temperatures are determined and tabulated. C_e = dissolved oxygen concentration in mg/l at water temperature, T, altitude, E. S = saturation factor of dissolved oxygen. E = altitude (elevation in feet). Q = carrying capacity in lbs fish/gpm. C = minimum dissolved oxygen concentration in effluent water in mg/l. These equations are adequate for salmonid hatchery planning and design not only because they reflect the hatchery operations, but because many important factors affecting the water supply are included. (Auth.)

14370. Taylor, Warner G. (Bur. of Sport Fish. and Wildl., Leavenworth National Fish Hatchery, Leavenworth, Washington). 1971. A DEVICE FOR SORTING SALMONID EGGS. Progr. Fish-Cult., 33(4): 224-226.

A photoelectric device accurately sorted dead and eyed coho salmon (Oncorhynchus kisutch) eggs. Maximum and minimum sorting rates were 350,000 and 250,000 eggs per hour. An electronic counter provides a running tally of dead and live eggs. The rejection of good eggs as dead eggs was 0.8 percent. Less than 1 percent of the dead eggs were accepted as live because of silt accumulation on fungused eggs. Mortality of 368,000 eggs from sort to first-fed fry was 13.6 percent. Mortality of 362,000 eggs sorted by salt flotation was 12.2 percent. Mortality of eggs conveyed to the sorter manually and automatically was 13.1 and 14 percent. (Auth.)

14371. Engstrom-Heg, Robert (N. Y. Dept. of Environ. Conservation, Bur. of Fish Lab., Livingston Manor, New York). 1971. A LIGHTWEIGHT MARIOTTE BOTTLE FOR FIELD, LABORATORY, AND HATCHERY USE. Progr. Fish-Cult., 33(4): 227-231.

A polyethylene aspirator carboy can be fitted with a stainless steel air-inlet tube of adjustable length and provided with a series of perforated outflow screwcaps. The resulting Mariotte bottle is an easily portable constant-flow device for introducing chemicals into laboratory, hatchery, or stream waters. The bottle may be accurately preset to provide discharge rates ranging from 68 to 2,500 cc/min. A table and nomographs give the proper settings for various outflow rates. (Auth.)

14372. Brauhn, James L. (Bur. of Sport Fish. and Wildl., Fish-Pesticide Research Lab., Columbia, Missouri). 1971. ISOLATION OF Aeromonas liquefaciens FROM LARGEMOUTH BASS EGGS AND SAC FRY. Progr. Fish-Cult., 33(4): 236-237.

The isolation of Aeromonas liquefaciens from the eggs of largemouth bass (Micropterus salmoides) is described. Losses of largemouth bass eggs were 98% in some instances. Pathogenicity of Aeromonas liquefaciens to largemouth bass fry was noted. (Auth.)

14373. Cardwell, Rick D., and Lynwood S. Smith (Fish. Res. Inst., Coll. of Fish., Univ. of Wash., Seattle, Washington). 1971. HEMATOLOGICAL MANIFESTATIONS OF VIBRIOSIS UPON JUVENILE CHINOOK SALMON. Progr. Fish-Cult., 33(4): 232-235.

Juvenile chinook salmon (Oncorhynchus tshawytscha) were reared in sea water after their transfer from fresh water. Thirty days following the transfer, visible signs of disease were observed on about half of the 21 fish in a 240-liter plexiglass aquarium. The etiologic agent was tentatively identified by bacteriological tests to be a species of Vibrio. Hematological analyses were made to assess the affects of the disease. Packed cell volume, hemoglobin concentration, corpuscle number, and plasma dissolved solids were significantly lower in visibly diseased salmon than in salmon resident in the same aquarium that possessed no visible signs of disease (apparently healthy). There were no significant differences in mean corpuscular volume, mean corpuscular hemoglobin, and mean corpuscular hemoglobin concentration (MCHC) between these two groups. Relative to healthy control salmon, all hematological variables (except MCHC) of both diseased and apparently healthy salmon were significantly reduced. Observations of circulating leukocytes suggested similar enhancement of leukocyte production in both diseased and apparently healthy salmon. (Authors)

14374. Gale, William F. (Biol. Dept., Jackson State College, Jackson, Mississippi). 1971. SHALLOW-WATER CORE SAMPLER. Progr. Fish-Cult., 33(4): 238-239.

A shallow-water core sampler for use in water up to 5 m feet was designed to sample sand to silt substrata. Improved features of this sampler included an unobstructed and larger self-cleaning tube. Construction and operational instructions are presented. (Auth.)

14375. Kerby, Jerome Howard (Va. Inst. of Marine Sci., Gloucester Point, Virginia). 1971. A FAIL-SAFE DEVICE FOR LABORATORY AQUARIUMS. Progr. Fish-Cult., 33(4): p. 241.

Two variations of an inexpensive fail-safe aeration device for laboratory aquariums are described. The device will provide an independent emergency air supply for several hours should cessation of the primary air supply occur because of electrical or mechanical failure. (Auth.)

14376. Hiller, Jacob M., and Alfred Perlmutter (Dept. of Biol., N. Y. Univ., Graduate School of Arts and Sci., New York, New York). 1971. EFFECT OF ZINC ON VIRAL-HOST INTERACTIONS IN A RAINBOW TROUT CELL LINE, RTG-2. Water Research, 5(9): 703-710.

A study was undertaken to determine the effects of the metal zinc, in virus-host interactions, in the rainbow trout cell line, RTG-2. Titers of infectious pancreatic necrosis virus showed a significant enhancement, when cultured in the presence of 10.0 ppm zinc. Average enhancement equaled an increase in titer of 69.6 percent. At a concentration of 7.5 ppm zinc, no effect was observed. Treatment of cell monolayers with 10.0 ppm zinc prior to inoculation with virus was sufficient to evoke the enhancement response. A mechanism of action is suggested in which zinc reduces the net negative charge on, either or both, the cellular or viral surfaces. This, in turn, reduces the electrostatic barrier between virus and cell and so enhances the adsorption of virus to the cell surface. It is proposed that since metallic cations can increase infectivity of disease causing organisms (i.e., viruses), the studies to determine "Biologically Safe" concentrations of these cations should include experiments on their interactions with virus-host systems. (Authors)

14377. Willford, Wayne A. (Great Lakes Fish. Lab., U. S. Bur. Sport Fish. and Wildl., Ann Arbor, Michigan). 1971. HEAVY METALS RESEARCH IN THE GREAT LAKES, 1970-71. Contribution 441 of the Great Lakes Fish. Lab., reprint from "Prevalence and effects of toxic metals in the aquatic environment", Proc. Workshop on Toxic Metals in Water; Water Resources Res. Inst., Univ. of No. Carolina, Raleigh N.C., Report No. 57.

Data are discussed concerning concentrations of mercury, arsenic and selenium in fishes of the Great Lakes.

14378. Nebeker, Alan V. (U. S. Dept. of Interior, Natl. Water Qual. Lab., Duluth, Minnesota). 1971. EFFECT OF HIGH WINTER WATER TEMPERATURES ON ADULT EMERGENCE OF AQUATIC INSECTS. Water Research, 5(9): 777-783.

The larvae of 10 species of aquatic insects (Trichoptera, Plecoptera, Ephemeroptera, and Diptera) were subjected to unseasonably high winter water temperatures in the laboratory from November through July. The stonefly Pteronarcys dorsata and the burrowing mayfly Hexagenia limbata emerged in January, 5 months earlier than their natural June emergence time. All other test species exhibited similar premature emergence under test conditions. The time between emergence of males and females was increased by increased water temperatures. (Auth.)

14379. Kemp, P. H. (Natal Reg. Lab., Natl. Inst. for Water Research, Durban, South Africa). 1971. CHEMISTRY OF NATURAL WATERS - V. HARDNESS. Water Research, 5(10): 933-941.

The definition and measurement of total, temporary and permanent hardness are discussed. A stoicheiometric division of the total hardness into carbonic and non-carbonic components (called other names by other authors) is also made. After consideration of the values of the relevant solubility products, it is shown that the non-carbonic hardness is approximately equal to the permanent hardness, apart from about 25 mg l^{-1} of $CaCO_3$ which remains in solution after the deposition of the temporary hardness. Natural waters with TDS less than about 70 mg l^{-1} therefore do not show temporary hardness. There is no invariable relationship between the temporary and permanent hardnesses of a water and its scale-forming powers as measured by the pH_s. (Auth.)

14380. Kemp, P. H. (Natal Reg. Lab., Natl. Inst. for Water Research, Durban, South Africa). 1971. CHEMISTRY OF NATURAL WATERS - VI. CLASSIFICATION OF WATERS. Water Research, 5(10): 943-956.

A scheme is proposed for standardizing water analyses to make them directly comparable despite differences in TDS. This utilizes the molar concentrations of the acids and bases considered to be dissolved in the water and leads to a convenient diagrammatic representation of water analyses. Comparison of Natal river waters by this means shows that they possess various features in common and can be grouped together in a series of chlorided waters. Rain water and sea water also fit into this series, as do many American river waters. A number of American river waters do not fit into this series but rather appear to constitute a series of sulphated waters of rather different composition. The technological properties of waters (buffer capacity, pH_s, hardness, etc.) are strongly dependent on TDS and waters of either series can occur at any level of TDS. Since the chemical composition of a water is not arbitrary but rather appears to be governed by the series relationships, TDS is of greater importance than chemical composition in any classification of waters from a practical standpoint. Water quality is an ill-defined concept. It is often more useful to consider the probable utility of the water, and a broad assessment of this can be obtained from knowledge of the electrical conductivity of the water and the BOD. Taking into account various accepted specifications for water for particular uses, a scheme of classification of waters into five classes according to probable utility is proposed. This has a simple statistical basis and can be adapted, with scant loss in precision, for use where only few samples of the water have been studied. The classification leads to a clear and consistent picture of the present water sources of Natal. (Auth.)

14381. Kanid'ev, A. N., and S. I. Gerasimchuk (VNIIPRKh). 1971. THE KRILL AND THE LEDA IN TROUT RATION (Kril' i Leda v Ratsione Foreli). Rybnoe Khozyaistvo No. 9, pp. 20-21. In Russian.

Tests were conducted to determine the value of krill flour and flour of the mollusc "leda" in trout ration. Krill flour contains about 50% moist protein and can serve as one of the main components in trout ration. "Leda" flour contains calcium and other inorganic substances, as well as micro-elements. The experimental feed proved to be not only more effective, but also cheaper than a spleen diet. It is close to the most effective of the well known granulated feeds.

14382. Vasetskiy, S. G. (Inst. of Developmental Biol., USSR Acad. of Sciences, Moscow, USSR). 1971. FISHES OF THE FAMILY POLYODONTIDAE. Journal of Ichthyology, 11(1): 18-31 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

A review is given of the literature on the systematics, anatomy, ecology, biology and fishery of the family Polyodontidae - the paddlefish [Polyodon spathula (Walbaum)] and the Chinese paddlefish [Psephurus gladius (Martens)]. Particular attention is paid to studies of embryonic development and the development of methods for artificial propagation of the paddlefish.

14383. Kulemin, A. A., I. I. Makkoveyeva and M. I. Solopova (Dept. of Zool., Yaroslavl State Teacher-Training Inst., Yaroslavl, USSR). 1971. AGE COMPOSITION, GROWTH RATE AND CONDITION OF THE PIKE [Esox lucius (L.)] OF LAKE PLESHCHEYEVO. Journal of Ichthyology, 11(1): 31-36 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

Data are given concerning the age composition, increase of length and weight and condition of the Lake Pleshcheyevo pike. Increase in the weight of pike in this body of water is most intensive after an age of five years, and it should therefore be regarded as irrational to catch younger specimens. The low numbers of the pike in Lake Pleshcheyevo make it essential to increase its protection.

14384. Maksimov, V. A. (Kamchatka Dept., Pacific Res. Inst. for Sea Fish. and Oceanog. (KOTINRO), Petropavlovsk-Kamchatskiy, USSR). 1971. REPRODUCTIVE BIOLOGY OF THE FRESHWATER MYKISS [Salmo mykiss (Walbaum)] FROM THE KAMCHATKA RIVER BASIN. Journal of Ichthyology, 11(1): 36-44 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

A description is given of the spawning stock of the mykiss from the Kishimshima River. Materials are given on age, size-weight composition, fecundity, ratio of the sexes, scale structure, etc. The spawning grounds are described. A connection is noted between the commencement of the spawning run of the mykiss, water temperature and the commencement of the spring flood. The comparison which is made with published data justifies the assumption that the mykiss of East Kamchatka is similar to Western American species of the genus Salmo with respect to reproductive biology.

14385. Goryunova, A. I. (Kazakh Fish. Res. Inst. (KazNIIRKh), Alma-Ata, USSR). 1971. VARIABILITY IN THE RATE OF EMBRYOGENY OF THE GRASS CARP [Ctenopharyngodon idella (Val.)]. Journal of Ichthyology, 11(1): 44-48 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The rate of embryonic development of the grass carp is not the same in the course of the spawning season: as the eggs mature and overmature the rate of development of the fast-growing embryos increases. The heterochronicity of development, which is a quantity expressing the amplitude of the stage difference at a given moment of development is reciprocally related to the viability of the eggs. In eggs with high indices of heterochronicity there is a shift in the relationship between the duration of development of the embryos in the egg capsule and the time of their hatching. Since the commencement of hatching is retarded, the duration of development in the capsule is increased. The actual process of hatching, conversely, takes place in a shorter period than under normal conditions.

14386. Shcherbina, M. A., and O. P. Kazlauskene (All-Union Pond Fish. Res. Inst. (VNIIPRKh) USSR). 1971. THE REACTION OF THE MEDIUM AND THE RATE OF ABSORPTION OF NUTRIENTS IN THE INTESTINES OF THE CARP [Cyprinus carpio (L.)]. Journal of Ichthyology, 11(1): 81-85 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

An account is given of experimental data characterizing interlinked changes in the pH of the chyme, its chemical composition and the rate of absorption of nutrients in the digestion by yearling carp of artificial foods containing different amounts of the nutrients investigated.

14387. Lapin, Yu. Ye (A. N. Severtsov Inst. of Evolutionary Morphology and Animal Ecology, USSR Acad. of Sci., Moscow, USSR). 1971. NEW DATA RELATING TO DIRECT DETERMINATION OF THE AGE OF THE PINK SALMON [Oncorhynchus gorbuscha (Walbaum)] BY MARKING. Journal of Ichthyology, 11(1): 49-59 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The great diversity in the rate of growth and development to be noted in the pink salmon contradicts the widely held opinion that all mature at the same age (two years). Direct determination of the age of the pink salmon by marking has shown that in addition to mass maturation in the second summer some individuals mature at an older age. The results of direct determination of the age of the pink salmon by marking were seriously at variance from the very beginning with the opinion that this salmon has only a two-year life cycle, an opinion which arose and was consolidated due to inaccuracies in the determination of age from the scales. It is suggested that the single zone of converged sclerites on the scale of the pink salmon (ring), which reflects a definite period in its ontogeny (accelerated growth on transition to abundant food), does not always signify its age.

14388. Konovalov, S. M., V. Ye. Il'in, and G. Ya. Shcherbinin (Inst. of Marine Biol., Vladivostok; Kamchatka Dept. Pacific Res. Inst. for Sea Fish. and Oceanog. (KOTINRO), Petropavlovsk-Kamchatskiy, USSR). 1971. STRUCTURAL FEATURES OF THE SCALES OF YOUNG SOCKEYE SALMON [Oncorhynchus nerka (Walbaum)] FROM THE LOCAL POPULATION OF LAKE AZABACH'YE. Journal of Ichthyology, 11(1): 59-70 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

Data in the literature indicate considerable diversity in the structure of the scales of the sockeye from different bodies of water. Structural analysis of the scales of yearling sockeye from Lake Azabach'ye (Kamchatka River basin) revealed several types in the young. Qualitative and quantitative comparison of these types with respect to a number of characters showed that they were well distinguished one from the other and could be combined into three groups: 1) with a true annulus, 2) without narrow winter sclerites, 3) with one or more false annuli. It is at present impossible to determine definitely the status of the groupings distinguished by these characters. Nevertheless, they are distinguished by ecology and are undoubtedly ecological groupings. However, these groupings are at the same time evidently genetic, i.e., they are isolates, and the differences detected in their ecology are intensified by the dissimilarity of their gene pools. The investigation of the sockeye of Lake Azabach'ye justifies the assumption that many of the characters studied are inherited and may appear in one or more isolates of this local population.

14389. Tleuov, R. T. (Fish Mgmt. Lab., Natural Sciences Joint Inst., Kara-Kalpak Branch, Uzbek Acad. of Sci., Nukus, USSR). 1971. CHANGES IN THE FEEDING HABITS OF THE SPINY STURGEON [Acipenser nudiventris (Lovetzky)] AND THE ROLE OF THIS FISH IN BIOLOGICAL IMPROVEMENT OF THE ARAL SEA. Journal of Ichthyology, 11(1): 71-74 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

Seven goby species inhabit the Aral Sea. All of them are fishes of no commercial value; the numerous monkey goby (Neogobius fluviatilis) and the "bubyr" [Bubyr caucasicus (Berg)] have become firmly established as part of the diet of the predatory fishes of the Aral Sea. An account is given in the present paper of facts concerning the transition of the Aral spiny sturgeon to predation in connection with the colonization of the Aral Sea by gobies and the sand smelt, an atherinid fish. Data are given concerning the age requirements of the Aral spiny sturgeon for different goby species of different sizes and the significance of the sturgeon as a predator by comparison with other predators in consumption of the immigrant species. Consideration of the materials shows that the spiny sturgeon is more attached to feeding on gobies than are the other predators of the Aral Sea, thanks to the biological identity of the two groups of fishes.

14390. Popchenko, V. I. (Konchezersk Biol. Sta., Petrozavodsk State Univ., USSR). 1971. CONSUMPTION OF OLIGOCHAETA BY FISHES AND INVERTEBRATES.

Journal of Ichthyology, 11(1): 75-80 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

Analysis of the food of benthophages in bodies of water in Karelia, the Komi ASSR, and Murmansk and Archangel Provinces has shown that Oligochaeta are consumed by bream, carp, ide, roach, perch, ruffe, whitefish and other fishes. Oligochaeta are also consumed by many species of aquatic invertebrates: the larvae of dragonflies, caddis flies, alder and snake flies, beetles, etc. To record Oligochaeta in the food of fishes and benthic invertebrates it is essential to carry out an investigation of fresh material using a microscope, since the macroscopic method of investigation frequently leads to some underestimation of the role of Oligochaeta in the diet of fishes and invertebrates.

14391. Shabalina, A. A. (Lab. of the Physiol. of Fishes, State Res. Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, USSR). 1971. COMPARATIVE ANALYSIS OF THE RESULTS OF DETERMINATION OF LIPIDS IN FISHES BY THE METHODS OF SOXHLET AND FOLCH. Journal of Ichthyology, 11(1): 85-88 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

Consideration is given to the question of determination of the total lipids of fishes by the methods of Soxhlet and Folch. No significant differences were detected between them in determination of the total fat content of trout underyearlings and yearlings. The method of Folch must be used for lipid determination in fish organs and tissues (muscles, liver, blood serum, eggs, embryos).

14392. Shubina, T. N. (Central Sturgeon Fish. Res. Inst. (TsNIORKh), All-Union Res. Inst. for Sea Fish. and Oceanog. (VNIRO), Moscow, USSR). 1971. SPAWNING AND POST-SPAWNING MIGRATIONS OF THE SEVRYUGA [Acipenser stellatus (Pallas)] IN THE LOWER VOLGA - ROUTES AND SPEEDS. Journal of Ichthyology, 11(1): 88-97 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

An account is given of the results of experimental studies of the distribution of the sevryuga on the river bed, the behavior of the fish in the river during the period of anadromous migration, and the activity of the spawning run and the downstream migration. It is established that the distribution of upstream-migrating and downstream-migrating males and females in the flow is different, that the distribution of fish of different size categories on the bed is not the same, and that there is periodic resting of the largest upstream-migrating fish (especially females) during the spawning migration. The speeds of the males and females are determined. The efficiency of the moving fish in relation to flow rate is established.

14393. Travkina, G. L. (Dept. of Ichthyology and Hydrobiology, Leningrad State Univ., USSR). 1971. USE OF QUANTITATIVE ASSESSMENT TO CHARACTERIZE THE STATE OF FISH OVARIES. Journal of Ichthyology, 11(1): 120-123 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The results of estimation of the absolute number of oocytes provide a reliable picture of the content of oocytes of the different states in the gonads of ruffe in stage IV of maturity and also indicate that the material in the body of water concerned is comparatively uniform and may be used for experiments the object of which is to clarify the reaction of the ovary to hormonal stimuli.

14394. Karpevich, A. F., and N. K. Lukonina (Consultative Council on Aspects of Acclimatization, Ichthyological Comm., USSR Ministry of Fisheries, USSR). 1971. TRANSPLANTATIONS OF FISHES AND AQUATIC INVERTEBRATES IN 1967. Journal of Ichthyology, 11(1): 98-112 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

14395. Rothschild, B. J. (Center for Quantitative Sci. in Forestry, Fish. and Wildl., and Fish. Res. Inst., Univ. of Wash., Seattle, Washington). 1971. A SYSTEMS VIEW OF FISHERY MANAGEMENT WITH SOME NOTES ON THE TUNA FISHERIES. FAO Fisheries Technical Paper No. 106, 33 p.

14396. Kazakov, R. V. (Lab. of Anadromous Fishes, State Res. Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, USSR). 1971. EXPERIMENTAL VERIFICATION OF THE EFFECT OF THE TEMPERATURE REGIME OF EGG INCUBATION ON THE CONDITION OF EMBRYOS AND LARVAE OF THE NEVA RIVER POPULATION OF ATLANTIC SALMON [Salmo salar (L.)]. Journal of Ichthyology, 11(1): 123-128 published by Amer. Fish. Soc. in cooperation with Scripta Publishing Corp.

The survival of larvae in these experiments in the period between hatching and transition to mixed feeding was best when eggs were incubated at a temperature of 5-6°C to the stage at which the tail bud reached a length of 1.5-2.0 mm or more, after which the temperature was gradually lowered to the normal winter temperature of 0.2-0.5°C and subsequently raised to early spring water temperature (combination of warm fall and warm spring). Survival and other fish culture characteristics were sharply deteriorated in larvae from variants in which water temperature in the fall was lowered at stages around the closure of the blastopore. Mass mortality of larvae was observed on transition to mixed feeding (after-effect phenomenon). The fish-farming characteristics were higher in all variants of the experiment under conditions of an early warm spring than under conditions of a late cold spring.

14397. Johnson, Leon D. (Bur. of Research, Spooner, Wisconsin). 1971. GROWTH OF KNOWN-AGE MUSKELLUNGE IN WISCONSIN: AND VALIDATION OF AGE AND GROWTH DETERMINATION METHODS. Dept. of Natural Resources, Madison, Wisconsin Technical Bulletin No. 49, 24 p., illus.

From 1955 to 1969, all muskellunge stocked in Bone Lake, Lac Court Oreilles and Big Spider Lake were finclipped. The presence of this large number of known-age fish provided the opportunity to gather empirical growth data and to compare two widely used methods of determining age and growth. From 1956 through 1968, scale samples and fin sections were taken from 1,734 known-age fish and from 1,468 muskellunge considered to be partially known-age fish. Through the use of either the scale or fin section method, ages of muskellunge age I through IX could be fairly accurately determined. For fish between ages IX and XI, the fin section method was the more accurate of the two means of determining age. For fish age XII and beyond, outer annuli could not be distinguished and neither method was considered to be accurate. For making back calculations of growth, however, the scale sample method was found to be superior. Although most of the lengths calculated by both methods were within an inch of actual measurements made, use of the scale method was more reliable. Application of the fin section method of back calculating growth was found to be very limited due to the arbitrary way in which a correction factor for the growth equation was determined. On the basis of empirical and calculated data, differential muskellunge growth was found. Fish in Big Spider Lake were slow growing, fish in Lac Court Oreilles were average growing and fish in Bone Lake were fast growing. Although this growth variation was demonstrated, no explanations for this variation were found.

14398. Novotny, Donald W., and Gordon R. Priegel (Dept. of Elec. Engineering, Univ. of Wis., Madison, Wisconsin). 1971. A GUIDELINE FOR PORTABLE DIRECT CURRENT ELECTROFISHING SYSTEMS. Dept. of Natural Resources, Madison, Wisconsin Technical Bulletin No. 51, 22 p.

Anode current appears to be a good electrical measure of electrofishing effects with less current required as the water conductivity decreases. A simple guideline table listing minimum required current and suggested anode sizes for various voltages was assembled to effectively fish typical Wisconsin streams with portable direct current systems. Actual stream tests of conductivity (micromhos/cm) and generator voltage must be available in order to select the correct size anodes. The power required for effective electrofishing depends on water conductivity, size and number of anodes, water depth and stream size. A table of suggested power levels is included. Means of attaining the required current are discussed. In general, large electrodes have lower resistance and thus permit larger currents at a given voltage. The cathode should always be as large as possible and the anodes selected

to meet stream conditions and generator ratings. The output voltage of any generator drops as current is taken from the machine and this voltage drop can cause a serious loss of effectiveness in some generators under heavy loads. Current per anode is reduced as the number of anodes fed from a single generator is increased even if the generator voltage is constant. Quantitative results illustrating these effects are included.

14399. Neproshin, A. Yu., and A. S. Nikolaev. 1971. ON SPAWNING SOUNDS OF THE RED SALMON (O nerestovykh zvukakh krasnoĭ). Rybnoe Khozyaĭstvo No. 6, pp. 14-16. In Russian.

Investigations revealed that the red salmon is acoustically active. In order to establish a connection of the sound signals with the behavior of different individuals during spawning, it is necessary to make detailed observations with the use of a multichannel receiving-recording apparatus in conjunction with underwater motion-picture filming.

14400. Muzykovskiĭ, A. M., and N. N. Safonov. 1971. THE TOXIC EFFECT OF PHENASAL AND DEVERMINE ON FISH (Toksicheskoe deĭstvie fenasala i devermina na ryb). Rybnoe Khozyaĭstvo No. 6, pp. 26-27. In Russian.

Phenasal and devermine are well known as highly effective and little toxic antihelminthics against cestodes of man and warmblooded animals. Devermine has the same structural formula as phenosal but is prepared from different raw material. Their therapeutic efficacy proved to be the same. In experiments with carp it was determined that the solubility of phenasal (devermine) increases considerably after traversing the intestine of fish, and that the lethal concentration of the preparation in water is 0.2-0.3 mg/l; this can vary depending on the water temperature and oxygen content. Dying fish recovered when placed in fresh water. Dehelminthization of carp with phenasal (devermine) proceeds without complications if the average depth of the water in ponds is kept at about 100 cm and the necessary inflow of water is provided. Introduction of medicated granulated feed into ponds in an amount greater than 200 kg/ha requires increase in the rate of water exchange.

14401. Gzhegotskiĭ, M. I., S. L. Doloshitskiĭ and N. V. Martynyuk (Lvov Medical Institute). 1971. THE TOXICITY OF SOME CHLORINE-CONTAINING HERBICIDES FOR FISH (Toksichnost' nekotorykh khlorsoderzhashchikh gerbitsidov dlya ryb). Rybnoe Khozyaĭstvo No. 8, pp. 27-28. In Russian.

The toxicity to fish of the herbicides propazine, pyramin, celatox, alisep, avadex and karbine was investigated. The absolutely lethal concentrations for the indicated herbicides are from 5.0 to 50.0 mg/l, the minimally lethal concentrations - from 0.5 to 10.0 mg/l, and the passive ones - 0.1-10.0 mg/l.

14402. Love, Richard H. (U. S. Naval Oceanog. Office, Washington, D. C.). 1971. MEASUREMENTS OF FISH TARGET STRENGTH: A REVIEW. U. S. Dept. of Comm. NOAA Fishery Bulletin 69(4): 703-715.

The concept of target strength and its application to the quantitative assessment of fishery resources are discussed. Methods of determining the echo characteristics of fish are reviewed and a number of results presented. Among the more important of these results are: (1) practically every case of interest to the fishing industry is in an acoustic region in which the target strength varies widely with fish size and aspect and acoustic frequency, (2) the major contributors to target strength in this region have been determined to be the swim bladder, flesh, and skeleton, and (3) the average maximum side-aspect and dorsal-aspect target strength of an individual fish have been determined for this region. (Auth.)

14403. Selgeby, James H. (U. S. Fish and Wildl. Serv., Ashland, Wisconsin). 1971. A BASKET FOR WASHING BENTHOLOGICAL SAMPLES. Trans. Amer. Fish. Soc., 100(3): 590-591.

To save time in washing benthological samples, a washing "basket" was designed which accommodates a Ponar dredge. (The basket could be modified rather easily for use with any small dredge.) The only additional equipment needed to employ the washing basket effectively is a pump that delivers about 8 gallons of water per minute.

14404. Mathisen, Ole A. (Fish. Res. Inst., College of Fisheries, Univ. of Wash., Seattle, Washington). 1971. ESCAPEMENT LEVELS AND PRODUCTIVITY OF THE NUSHAGAK SOCKEYE SALMON RUN FROM 1908 TO 1966. U. S. Dept. of Comm., NOAA Fishery Bulletin 69(4): 747-763.

Since the inception of a commercial fishery for sockeye salmon in the Nushagak District, Bristol Bay, Alaska, the annual yields have followed a definite pattern. Catches increased during a relatively short development phase of the fishery, then stabilized for some years and then declined in two steps separated by periods of relative stability. For years the cause of the decline had been thought to be overfishing, and various measures of curtailment had been placed upon the fishing industry. Evidence is presented in this paper that the average escapement or the potential egg deposition remained about the same during each of three periods (1908-1919, 1925-1945, and 1946-1966); hence the diminution in the runs was due not to lack of spawners but to a decline in the rate of return per spawner. So that the cause or causes of the present low reproductive potential can be ascertained, the effects of fishing on the stocks of salmon must be examined. Besides removing part of the run, the yearly commercial fishing operation may have altered either the age composition or the distribution of the escapement. Available historical records were examined for evidence of these types of changes but largely with a negative result; therefore, the hypothesis was advanced that the observed declining rate of return per spawner is caused by a declining basic productivity of the nursery areas. The latter is then ascribable to the cumulative effect of relatively little enrichment of bioenergetic elements from salmon carcasses since the instigation of commercial fishing operations in comparison with the prefishing era when the entire virgin run escaped to the spawning grounds. Suggestions are made for future field testing of this hypothesis. (Auth.)

14405. Nicholson, William R. (NMFS, Center for Estuarine and Menhaden Res., Beaufort, North Carolina). 1971. CHANGES IN CATCH AND EFFORT IN THE ATLANTIC MENHADEN PURSE-SEINE FISHERY 1940-68. Dept. of Comm., NOAA Fishery Bulletin 69(4): 765-781.

The catch, number of vessel weeks, and catch per vessel week in the Atlantic menhaden fishery increased during the 1950's. During this period fishing methods improved and the efficiency of vessels increased. Improvements included use of airplanes for spotting schools, aluminum purse boats, nylon nets, power blocks, and fish pumps for catching and handling fish, and larger and faster carrier vessels that could range farther from port. The catch and catch per vessel week began declining north of Chesapeake Bay in the early 1960's. By 1966, fish north of Chesapeake Bay had become so scarce that plants either closed or operated far below their capacity. In Chesapeake Bay the number of vessel weeks increased, and the catch and catch per vessel week decreased through the early and mid 1960's. Variations in catch, effort, and catch per unit of effort showed no trends in the South Atlantic. The annual mean number of purse-seine sets per day varied in different areas and ranged from about 2.0 to 4.5. The annual mean catch per set ranged from about 11 to 25 metric tons. (Auth.)

14406. Wilkens, E. Peter H., and Robert M. Lewis (NMFS, Southeast Fishery Center, Miami, Florida). 1971. ABUNDANCE AND DISTRIBUTION OF YOUNG ATLANTIC MENHADEN, Brevoortia tyrannus, IN THE WHITE OAK RIVER ESTUARY, NORTH CAROLINA. U. S. Dept. of Comm., NOAA Fishery Bulletin 69(4): 783-789.

The effect of salinity, temperature, tide, turbidity, and illumination on the distribution of larval, prejuvenile, and juvenile menhaden in an estuary was investigated. Most menhaden larvae entered the estuary in March after the water had warmed to about 10°C, and moved upstream to the low-salinity-freshwater zone where they transformed into juveniles. More larvae were caught in the lower estuary on flood tide. After transformation to juveniles they were caught in schools throughout the estuary. Turbidity and illumination did not affect the distribution of menhaden, but illumination affected catchability, since more menhaden were collected during night tows. (Authors)

14407. Corliss, Jane and Lee Trent (NMFS, Biol. Lab., Galveston, Texas). 1971. COMPARISON OF PHYTOPLANKTON PRODUCTION BETWEEN NATURAL AND ALTERED AREAS IN WEST BAY, TEXAS. U. S. Dept. of Comm., NOAA Fishery Bulletin 69(4): 829-832.

Phytoplankton production was compared between an undredged marsh area, a bay area, and an adjacent marsh area altered by channelization, bulkheading, and filling. Average gross production (mg carbon/liter/day) in the altered area (canals) was 8% higher than in the marsh and 48% higher than in the bay during June, July, and August 1969. Gross and net production were significantly higher in the canals and marsh than in the bay; differences between the canals and marsh were not significant. (Authors)

14408. Ebel, Wesley J., Earl M. Dawley, and Bruce H. Monk (NMFS, Biol. Lab., Seattle, Washington). 1971. THERMAL TOLERANCE OF JUVENILE PACIFIC SALMON AND STEELHEAD TROUT IN RELATION TO SUPERSATURATION OF NITROGEN GAS. U. S. Dept. of Comm., NOAA Fishery Bulletin 69(4): 833-843.

Thermal tolerance of juvenile chinook salmon (Oncorhynchus tshawytscha), coho salmon (O. kisutch), and steelhead trout (Salmo gairdneri) that had been held at various acclimation temperatures was lowered when test water was supersaturated (125-130% of saturation) with nitrogen gas. Increasing the depth of the test tank allowed the fish to compensate somewhat for the supersaturation by sounding, but substantial mortalities still occurred. A comparison of tolerance among the species test revealed that coho salmon were the most tolerant, chinook salmon next, and steelhead trout the least tolerant to temperature increases in the presence of supersaturation of nitrogen. (Authors)

14409. Sage, Martin (Univ. of Texas Marine Science Inst., Port Aransas, Texas). 1971. RESPIRATORY, BEHAVIORAL, AND ENDOCRINE RESPONSES OF A TELEOST TO A RESTRICTED ENVIRONMENT. U. S. Dept. of Comm., NOAA Fishery Bulletin 69(4): 879-881.

Observations indicate that acclimating fish to a restricting apparatus may stimulate the TSH cells and thyroid and produce changes in behavior and respiration. This may be particularly confusing where season changes are being investigated since thyroxine has been implicated in processes of acclimation and seasonal changes in fish thyroid activity are widespread and may be related to seasonal changes in respiratory rate.

14410. Yongue, William H., Jr., and John Cairns, Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. MICRO-HABITAT pH DIFFERENCES FROM THOSE OF THE SURROUNDING WATER. Hydrobiologia, 38(3-4): 453-461.

Polyurethane sponges were suspended in the surface waters of a Mecklenburg County, North Carolina pond that was posted and unused, a Cheboygan County, Michigan "acid" bog pond and an "alkaline" gravel-pit pond, and a Montgomery County, Virginia farm pond. The pH of the sponge water was often substantially different from that of the surrounding water (e.g. sponge water pH 6.8, pond water pH 10.5). These differences are attributed to the microbial communities inhabiting the sponges. If this is generally true for microbial growths associated with substrates, the relationship of these species to the quality of the surrounding water should be re-examined. (Authors summ.)

14411. Cairns, John, Jr., Tim Beamer, Sharon Churchill, Jeanne Ruthven (Virginia Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. RESPONSE OF PROTOZOANS TO DETERGENT-ENZYMES. Hydrobiologia, 38(2): 193-205.

These studies were divided into two parts: (1) "time until death" curves in which Paramecium caudatum Ehrenberg was exposed to selected concentrations of the detergent-enzyme Axion, and (2) exposure of fresh-water protozoan communities to selected concentrations of Axion. The former were carried out in test

tubes, the latter in plastic troughs with a constantly flowing fluid. Both types of bioassays were carried out with filtered water from Douglas Lake, Michigan, U. S. A. at a temperature of about 25°C. One hundred percent of an exposed population of Paramecium caudatum was killed in 20 to 30 minutes at a concentration of 100 ppm of Axion. No appreciable change in the controls was noted during these tests. The bioassays with fresh-water protozoan communities were carried out in plastic troughs with a constant flow of Douglas Lake water. During the exposure period the lake water flow was stopped and a flow of Axion solution was substituted for approximately three hours. After this exposure period lake water flow were restored. The number of species was determined before and at intervals following exposure. Appropriate controls were maintained. A three hour exposure to 56 ppm (introduced concentration) of Axion caused a 35 percent reduction in the number of species in less than five hours with recovery to the original number in approximately 145 hours; a three hour exposure to 75 ppm caused a 54% reduction in number of species in less than five hours with recovery to the original number in approximately 240 hours; 100 ppm produced a 55 percent reduction with recovery in approximately 200 hours; 125 ppm produced a 48% reduction with recovery in approximately 148 hours; 200 ppm caused a 78% reduction with recovery in about 140 hours. Response patterns vary as do those of bioassays with single species. However, it is important to note that each test community had different types of species present, and it is quite likely that some communities had a higher percentage of sensitive species than others. Since this variation also occurs in nature the tests are probably representative of the differences that exist when natural communities are exposed to wastes. Variation in control troughs was less than $\pm$ 10 percent in the number of species. (Authors summ.)

14412. Caillouet, Charles W., Jr., Bennie J. Fontenot, Jr., William S. Perret, Ronald J. Dugas, and Houston F. Hebert. 1971. CATCHES OF POSTLARVAL WHITE SHRIMP, Penaeus setiferus (Linn.), AND BROWN SHRIMP, P. aztecus Ives, AND TEMPERATURE AND SALINITY OBSERVATIONS IN VERMILION BAY, LOUISIANA, MARCH 1963 TO APRIL 1967. U. S. Dept. Comm., NOAA, NMFS, Data Report 64, 39 p. Hard copies and microfiche copies of this report are for sale by the U. S. Dept. of Comm., Nat'l Technical Information Service, 5285 Port Royal Road, Springfield, Virginia.

A small trawl towed in a semicircle of 30.5-m (100 ft) radius in the shallow water near the shoreline was used to collect postlarval white shrimp and brown shrimp. Dates and hour of sampling, catches of post-larvae, species composition of subsamples of the catches, and water temperature and salinity data are presented. (Authors)

14413. Baldwin, John (Oceanic Inst., Makapuu Oceanic Center, Waimanalo, Hawaii). 1971. ADAPTATION OF ENZYMES TO TEMPERATURE: ACETYLCHOLINESTERASES IN THE CENTRAL NERVOUS SYSTEM OF FISHES. Comp. Biochem. Physiol., 40(1B): 181-187.

Arrhenius plots of log V_{max} vs. 1/temperature for acetylcholinesterase (AChE) from the brains of fishes experiencing different thermal environments are essentially parallel throughout the habitat temperature ranges of the animals, indicating similar energies of activation. The affinity of the AChE enzymes for the substrate acetylcholine (ACh) varies with assay temperature and approaches a maximum value (minimum K_m) at the lower end of the habitat temperature range. It is considered unlikely that the adaptive significance of the K_m-temperature effect lies in the stabilization of reaction rates throughout the habitat temperature range. (Auth.)

14414. Mawdesley-Thomas, Lionel E. (Huntingdon Res. Centre, Huntingdon PE18 6ES, England). 1972. RESEARCH INTO FISH DISEASES. Nature 235(5332):17-19.

Although there have been many recent advances in research into fish diseases, some problems, for example, preventive medicine and the relationship between pollution and disease, remain to be investigated in detail. (Auth.)

14415. Moon, Thomas W., and P. W. Hochachka (Dept. of Zool., Univ. of Brit. Columbia, Vancouver 8, B. C., Canada). 1971. EFFECT OF THERMAL ACCLIMATION ON MULTIPLE FORMS OF THE LIVER-SOLUBLE NADP+-LINKED ISOCITRATE DEHYDROGENASE IN THE FAMILY SALMONIDAE. Comp. Biochem. Physiol., 40(1B): 207-213.

Three members of the family Salmonidae have been examined for multiple forms of the liver-soluble form of NADP+-linked IDH; species included were the lake, splake and brook trout. The number of enzyme subunits differed in these species, being one in lake, two in splake and four in brook trout. In some cases, the effect of thermal acclimation was found to shift the isozyme pattern to a dominant form, suggesting a temperature induction phenomenon. The significance of this is disucssed. (Authors)

14416. Fellman, J. H., E. S. Roth and T. S. Fujita (Dept. of Biochem., Univ. of Oregon Med. School, Portland, Oregon). 1971. STUDY OF TYROSINE AMINOTRANSFERASE IN DEVELOPING SALMON. Comp. Biochem. Physiol., 40(1B): 241-247.

A study of tyrosine aminotransferase was undertaken to determine whether this enzyme which is inducible in mammals is subject to similar control in salmon. Although spawning salmon exhibit high blood plasma levels of 17-hydroxycorticosteroids, the enzyme TAT activity remains essentially unaltered. Furthermore, attempts to increase the liver TAT activity in fingerling salmon using high levels of corticoids were unavailing. (Authors)

14417. Verigin, B. V. (Agrobiostation of Moscow State Univ., Moscow, USSR). 1961. RESULTS OF WORK ON ACCLIMATIZATION OF FAR EASTERN PHYTOPHAGOUS FISHES AND MEASURES FOR THEIR FURTHER ASSIMILATION AND STUDY IN NEW REGIONS. (Itogi raboty po akklimatizatsii dal'nevostochnykh rastitel'noyadnykh ryb i meropriyatiya po ikh dal'neĭshemu osvoeniyu i izucheniyu v novykh raĭonakh). Voprosy Ikhtiologii, Vol. 1, No. 4(21): 640-649. Translated by Robert M. Howland.

In the USSR, work has been carried out for a fairly long time on acclimatization of the phytophagous fishes in different waters. The silver carp and white amur have long attracted attention as very desirable objects for acclimatization. Only in the fifties did considerable work develop on acclimatization of the phytophagous fishes. From 1954 through 1957 the delivery of stocking material (2-3 summer fish and young-of-the-hear) was realized from the Amur River Basin. The delivered material was discharged in part into natural waters and reservoirs and partially left at piscicultural farms for scientific research work. The quantity of stocking material released must be regarded as very insignificant. Information on captures of white amurs and silver carp released into natural waters and reservoirs is still very meager as yet. Also, information on fish productivity, obtained from the culture of these fishes is as yet very scant due to the limitedness of stocking material in experiments. In order to obtain the maximal fish production from inland waters of all types it is desirable: to acclimatize phytophagous fishes in those waters where their natural reproduction is possible; to organize fattening culture in those fishery waters where spawning of these fishes is impossible but fattening is possible; to utilize them in pond pisciculture, and also in technical, irrigational and water supply waters; the latter, besides fish production, will afford a supplementary cultural effect due to melioration. Acclimatization of the silver carp is most promising in the large reservoirs of southern regions. As a fish of the pelagic zone it can adjust there to the vast open part, which is rich in phytoplankton, but which provides minimal fish production at present. Study of the reproductive biology of these fishes unfortunately does not provide a clear answer to the question about what conditions are necessary and adequate for the natural spawning of these fishes in areas that are new for them. Very broad prospects for utilization of the phytophagous fishes are revealed with mastery of their reproduction in ponds. For purposes of acclimatization and in addition for the accomplishment of other forms of colonization and utilization of the phytophagous fishes, a very great amount of stocking material is required. It is impossible to obtain it through the systematic

delivery of young from the Amur River or beyond the border. The best escape from such a situation is continuation for another two or three years of the shipment of batches of young at rates close to the present (i.e. in the amount of about 1 million specimens), and the creation in such a way of a multi-aged broodstock of these fishes in different geographic zones and areas, predominantly in the southern belt, which is better suited to the biological peculiarities af these fishes. On the basis of these broodstocks at piscicultural farms and in other waters, intensive research work must be developed on working out the biotechnology of artificial propagation of these fishes and the adjustment of such propagation to production scales. Apparently, initial efforts for fishery assimilation of the phytophagous fishes rationally will be concentrated in a few areas highly developed in regard to fisheries (including fishery science), and in areas which best meet the climatic requirements of these fishes. Such regions in the RSFSR can be the Krasnodar area, the Rostov district, the Volga River delta, the region of the reservoirs of the Lower Volga and Don River, the Moscow district and the adjoining areas. In addition, this should be carried out in the Ukraine, in Moldavia, and in the Republics of Middle Asia and Kazakhstan. Fishery assimilation of the phytophagous fishes requires the development of serious scientific investigations in this area.

14418. St. Amant, James A., and Sasaki Shoken. 1971. PROGRESS REPORT ON REESTABLISHMENT OF THE MOJAVE CHUB, Gila mohavensis (Snyder), AN ENDANGERED SPECIES. Calif. Fish & Game, 57(4): 307-308.

Three localities were planted with Mojave chubs as follows: Piute Springs, and Two Hole Springs in San Bernardino County; and South Coast Botanic Garden Pond at Palo Verdes, California. Further suitable sites for introductions are being searched. (Authors)

14419. Collins, Robson A. 1971. SIZE AND AGE COMPOSITION OF NORTHERN ANCHOVIES (Engraulis mordax) IN CALIFORNIA REDUCTION AND CANNING FISHERIES, 1968-69 SEASON. Calif. Fish Game 57(4): 283-289.

Over 1.3 billion northern anchovies weighing 57,173,594 lb. were landed for reduction and canning during the 1968-69 anchovy season. Sampling in southern California was composed primarily of 1 and 2 year old anchovies, while 2 and 3 year old fish dominated the central California catch. (Auth.)

14420. Turner, Jerry L., and Timothy C. Farley. 1971. EFFECTS OF TEMPERATURE, SALINITY, AND DISSOLVED OXYGEN ON THE SURVIVAL OF STRIPED BASS EGGS AND LARVAE. Calif. Fish Game 57(4): 268-273.

Laboratory experiments were conducted on the effects of salinity, temperature, and dissolved oxygen on the survival of artificially spawned striped bass (Morone saxatilis) eggs and larvae. Egg survival in salinities greater than about 1,000 ppm TDS, especially at higher temperatures, are greatly reduced if eggs are not water hardened in fresh water. Moderate reductions in dissolved oxygen (to 4 to 5 mg/liter) adversely affect the percent hatch of eggs and have a detrimental effect on larval survival. (Authors)

14421. Rawstron, Robert R. 1971. NONREPORTING OF TAGGED WHITE CATFISH, LARGEMOUTH BASS, AND BLUEGILLS BY ANGLERS AT FOLSOM LAKE, CALIFORNIA. Calif. Fish Game 57(4): 246-252.

Nonreporting of tagged white catfish, Ictalurus catus, largemouth bass, Micropterus salmoides, and bluegills, Lepomis macrochirus, by anglers at Folsom Lake, California, was 39%, 46%, and 69%, respectively. Nonreporting of white catfish less than 11.0 inches was approximately 2.5 times that for larger fish, although all size classes were equally vulnerable to the fishery. The $5-reward tag encouraged anglers to keep fish that otherwise would not have been retained. Anglers in California have shown a nonresponse ranging from 30 to 50% for a wide variety of freshwater fishes and approximately 40% as a general rule. (Auth.)

14422. Bauer, O. N. 1969. THE STUDY OF INFECTIOUS FISH DISEASES IN THE USSR. (Izuchenie infektsionnykh zabolevaniĭ ryb v SSSR). Infectious fish diseases and their control (Infektsionnye bolezni ryb i bor'ba s nimi), Izvestiya Gosudarstvennogo Nauchno-Issledovatel'skogo Instituta Ozernogo i Rechnogo Rybnogo Khozyaĭstva, Vol. 69, Ministerstvo Rybnogo Khozyaĭstva RSFSR, 5-12. Translated by Robert M. Howland.

A brief summary of the study of infectious diseases of fish in the USSR is given in the report. It is noted that investigations have not been sufficiently intense in this division of ichthyopathology. This is due to the absence of experimental bases for the arrangement of acute tests, inadequate supply of laboratories with modern equipment, and a shortage of highly qualified microbiologists.

14423. Orsi, James J. 1971. THE 1965-1967 MIGRATIONS OF THE SACRAMENTO-SAN JOAQUIN ESTUARY STRIPED BASS POPULATION. Calif. Fish Game 57(4): 257-267.

Striped bass (Morone saxatilis) migrations are described based on tag returns from the third in a series of tagging programs dating back to 1950. In 1965-66 the general migration pattern was essentially the same as it was in 1958-61. No return to the pattern of the early 1950's in which few bass entered San Francisco Bay or the Pacific Ocean occurred. In general, larger fish moved farther downstream. Only medium-sized and large fish went to sea, and then only in the summer and fall. Small fish were the only ones common in fresh water during the summer. Major differences between 1958-61 and 1965-66 were a population shift from San Francisco Bay to San Pablo Bay during the winter, a downstream movement of small and medium-sized fish into San Francisco Bay during the fall, a shorter residence time in the ocean during the summer and a reduced oceanic range. All are difficult to explain. Fish length seemed to influence migration pattern more than sex did. (Auth.)

14424. Von Geldern, C. E., Jr. 1971. ABUNDANCE AND DISTRIBUTION OF FINGERLING LARGEMOUTH BASS, Micropterus salmoides, AS DETERMINED BY ELECTROFISHING, AT LAKE NACIMIENTO, CALIFORNIA. Calif. Fish Game 57(4): 228-245.

Electrofishing gear was used for four consecutive summers at Lake Nacimiento to obtain data on the abundance and distribution of fingerling largemouth bass. Mean catches of fingerling bass per 1/4 mile of shoreline were extremely variable, ranging from a low of 3.2 in 1968 to a high of 129.9 in 1967. Ninety-five percent confidence intervals about the means ranged from $\pm$22.7 to $\pm$46.7%. Factors associated with large fingerling bass year classes were: (i) stable or rising water levels during the spawning period; (ii) high surface water elevations in April and May; and (iii) low abundance of adult threadfin shad (Dorosoma petenense). No relation between fingerling bass abundance and the abundance of spawners, yearling bass, or other game fish species was detected. Fingerling bass were most abundant in the westerly half of Lake Nacimiento where wind and wave action were relatively slight. The degree of shoreline slope was not a factor affecting the abundance of bass fingerlings. Shoreline sections relatively free of shelter produced larger average catches than sections containing moderate to large quantities of brush, rocks, or fallen logs. (Auth.)

14425. Menshutkin, V. V., and Yu. Ya. Kislyakov (Inst. of Evol. Physiol. and Biochem. of the Acad. of Sci. of the USSR, Leningrad, USSR). 1967. MODELLING OF A POPULATION OF COMMERCIAL FISH WITH CALCULATION OF THE VARIABLE GROWTH RATE. (Modelirovanie populyatsii promyslovoĭ ryby s uchetom peremennogo tempa rosta). Zoologicheskiĭ Zhurnal, 46(6): 805-810.

Fish growth is a complex adaptive process that depends not only on change in the food conditions, but also on the abundance and structure of the population. Expression of the growth function as an analytical formula in calculation of the effect of regulatory mechanisms is difficult; however, the building of a model permits one to determine by numerical methods the growth rate of a fish under conditions as complex as desired. A block diagram of the connections of one age group of a

population of commercial fish is presented. Such treatment does not reduce the community of methods of building the model for a population with any number of age groups. Assigned to each age group are the specific abundance and the average weight of individuals which enter into it. The conditions of a population at discrete moments of time are examined; for example, after a year, when shift from one age group into the next will be accompanied by change in abundance and average weight. -- Robert M. Howland

14426. Hubbs, Clark (Dept. of Zool., The Univ. of Texas at Austin, Austin, Texas). 1971. COMPETITION AND ISOLATION MECHANISMS IN THE Gambusia affinis x G. heterochir HYBRID SWARM. Bull. Texas Mem. Mus. 19: 1-46. (Copies may be obtained from the Tex. Memorial Museum, Austin, Texas for $1.00).

More than 96,000 Gambusia were sampled to determine interactions among Gambusia affinis, G. heterochir, and their hybrids in Clear Creek, Menard County, Texas. Gambusia abundance was positively associated with shallow water and dense vegetation. Optimal habitats had larger fish and more mature females per male than sparsely occupied waters. Gambusia are seldom active at night and have morning and evening activity peaks. The activity cycles are size related with small fish having more equivalent activity at all time periods than large fish. The morning activity cycles of G. heterochir are earlier than those of G. affinis. Gambusia grow rapidly until sexual maturity and then slow growth (males stop) except during spring months. The breeding season extends from March through September; young born early in the year are reproductive by mid-season and young born in mid-season all reproductive by the next season. Fecundity increases with female size and the best exponential fit is 1.9 assuming reproductive activity begins at 11 mm. The two parental species have different preferred habitats with G. heterochir being most abundant in water with a low pH and more consistent temperature. The regions are also typified by two distinct morphs of Ceratophyllum and Gammarus. The morphologic distinctions of the Gambusia have remained consistent for more than a decade despite extensive hybridization; however, the ecologic separation has become more distinct with time. Amphipods are the primary diet of G. heterochir; G. affinis eats many insects except in winter when it eats many amphipods. In cold months, G. affinis migrate into the G. heterochir environment and may swamp resident populations. Female G. affinis that remain in the G. heterochir environment the next summer have a drastically reduced fecundity compared with those that return to the typical G. affinis environment. Most of the reduced fecundity results from suboptimal physico-chemical conditions but interspecific competition exacerbates the adverse effects. The hybridization results from and is maintained by synchronous occupation of suboptimal G. heterochir environments by omega G. heterochir males and migratory G. affinis females. Survival of F hybrids is enhanced by the scarcity of other arthropod eating fishes. (Auth.)

14427. Lesnikov, L. A. (State Sci. Res. Inst. of Lake and River Fishery, Leningrad, USSR). 1970. PECULIARITIES OF THE ACTION OF POLLUTANTS ON A POPULATION OF AQUATIC ORGANISMS. (Osobennosti deĭstviya zagryaznenii na populyatsii vodnykh organizmov). Voprosy Vodnoĭ Toksikologii, Publisher "Nauka", Moscow, 61-66. Translated by Robert M. Howland.

Sublethal concentrations of a pollutant, which do not cause increase in the death rate of the organisms with their optimal condition (at 0.10-0.05 mg CO/l, for example), cause marked and significant loss, which depends clearly on the concentration of pollutant, during periods of high values of the biomass (saturation biomass). Therefore, when the establishment of fishery maximum permissible concentrations (MPC) is confined only to experiments on organisms held under optimal conditions, it is inadequate. Three basic types of the direct action of pollutants can be isolated. In the first case pollution can cause the death of a certain portion of the individuals in a population (young, sexually mature, or of one sex - most often males). This is noted rather frequently in short-term action of pollution, and also in the chronic action of certain types of pollutants; for example, the distiller liquid of soda factories. In the second case pollution affects the overall condition of the organisms (metabolism, etc.). Here, the effect of pollution

is analogous to the effect exerted by parasites, and also to the effect with divergence of environmental factors (background factors, for example) from the optimum, etc. The principal effect of such pollution consists of the fact that with decrease in the density of a population, the individuals, its components, cannot shift to optimal physiological condition. In the third case the effect of the pollutants is expressed in disturbance of the processes of oogenesis and embryogenesis, which leads either to cessation of reproduction (close to complete sterility of mature individuals), or to the spawning of poor-quality or non-viable offspring. Such action shows the most negative consequences for a population, especially if the substances have cumulative effect (many pesticides, for example). Therefore, even the slightest deviations in development under the influence of pollution, or a small percentage of disturbances, require most serious attention to the action of the particular pollutant.

14428. Goncharov, G. D., and V. R. Mikryakov (Inst. of the Biol. of Inland Waters, Acad. of Sci. of the USSR, Borok, USSR). 1970. THE EFFECT OF LOW CONCENTRATIONS OF PHENOL ON ANTIBODY FORMATION IN CARP, Cyprinus carpio L. (Vliyanie malykh konsentratsiĭ fenola na antiteloobrazovanie u karpov Cyprinus carpio L.). Problems of Aquatic Toxicology (Voprosy Vodnoĭ Toksikologii) Publisher, "Nauka", Moscow, 171-175. Translated by Robert M. Howland.

The results of investigations of the effect of low concentrations of phenol on antibody formation in carp in a chronic experiment show that in holding carp in a 12.5 mg/l phenol solution the formation of immunoglobulins decreases and the amount of total protein in the blood sera of the fish drops. Apparently, as a result of disturbance of the motor-food activity of the fish under prolonged influence of phenol, endogenous feeding is intensified in the carp organism, which leads to decrease in the synthesis of antibodies. At the same time the possibility of disturbance to perception of information by immunoglobulin producer-cells is not excluded, and consequently the resistance of the fish to infection is depressed.

14429. Gorbach, E. I. (Freshwater Fish Lab. of the Amur Div. of the Pacific Ocean Sci. Res. Inst. of Fish. and Oceanog., Khabarovsk, USSR). 1961. AGE COMPOSITION, GROWTH AND AGE OF ONSET OF SEXUAL MATURITY OF THE WHITE Ctenopharyngodon idella (Val.) AND THE BLACK Mylopharyngodon piceus (Rich.) AMURS IN THE AMUR RIVER BASIN. (Vozrastnoĭ sostav, rost i vozrast nastupleniya polovoĭ zrelosti belogo Ctenopharyngodon idella (Val.) i chernogo Mylopharyngodon piceus (Rich.) Amurov v Basseĭne R. Amura). Voprosy Ikhtiologii, Vol. 1, No. 1(18): 119-126. Translated by Robert M. Howland.

In comparison with 1930-1940 the average sizes of the white amur in catches on the lower Amur and in the lower reaches of the Ussuri River decreased markedly. In accordance with this, the number of young fish which had never spawned (4+ and 5+ in age) grew in the makeup of the commercial catches. Large individuals (with a length of 80-90 cm and more and 10-15 years of age) came to appear very rarely in the catches; only in the lower part of the Middle Amur (in the Ventselevo-Golovino section) do such fish occur in significant numbers. The growth rate of the white amur increased somewhat. All of this in consideration of the significant reduction in catches of the white amur in the lower Amur and in the lower reaches of the Ussuri River indicates decline of its stocks in these areas of the basin. The white amur grows more slowly in the northern part of the basin than in the southern part. Linear growth slows down with age and drops markedly in the 8-9th year of life. Weight growth increases with age of the fish, especially from the 5-7th year of life. Solitary individuals become sexually mature in the seventh year of life, having reached a length of 54-55 cm; the main mass of fish first spawns at the age of 9-10, having reached a length of 68-75 cm. The black amur grows somewhat more slowly than the white amur. The character of growth in them is the same. The growth rate in the black amur has not changed for the last decade. The black amur becomes sexually mature no earlier than 8-9 years of age, having reached a length of about 75-80 cm. In the commercial catches of the black amur in the River basin, small young fish also predominate (with a length of 50-60 cm, 4+ - 6+ in age). The current catching of large numbers

of sexually immature amurs substantially undermines their reserves. Therefore, along with propagation of these fishes at piscicultural farms, it is necessary to curtail sharply the catch of young fish. For this purpose it is necessary to establish a commercial size of no less than 70-75 cm for the amurs. The catch of large amurs (with a length of 80-100 cm, 10-15 years of age) will enable improvements of natural reproduction and more complete utilization of the food resources, and will allow the fisheries to obtain higher quality production. (From auth. conc.)

14430. Menshutkin, V. V., and Yu. Ya. Kislyakov (Inst. of Evol. Physiol. and Biochem. of the Acad. of Sci. of the USSR, Leningrad, USSR). 1968. MODELLING THE EFFECT OF THE FOOD BASE ON THE DYNAMICS OF A FISH POPULATION. (Modelirovanie vliyaniya kormovoĭ bazy na dinamiku populyatsii ryb). Zoologicheskiĭ Zhurnal, 47(3): 325-330. Publisher, "Nauka". Translated by Robert M. Howland.

A commercial fish population is examined as a complex cybernetic system. Bearing on the principles derived for separate individuals and groups of homogenous individuals, the authors explain the effect of the food base on a population as a single complete object possessing a complex structure. The model is realized on a digital computer. The size of the food base changing with time is fed into the input of the system and the catch for 50 years is traced. Two rules of change of the food base are examined: sinusoidal and chance with normal distribution. The complex effect of the food base on the dynamics of a fish population is established on the model. It is shown that not every fluctuation of the food base will be repeated in change in the biomass of a commercial fish population and not every periodic fluctuation of catches of a commercial fish is necessarily connected with variations of the food base.

14431. Mazmanidi, N. D. (Saratov Div. of the State Sci. Res. Inst. of Lake and River Fishery, Saratov, USSR). 1970. THE ROLE AND PROBLEMS OF PATHOLOGICAL ANATOMY IN ICHTHYOTOXICOLOGY. (Rol' i zadachi patologicheskoĭ anatomii v ikhtiotoksikologii). Voprosy Vodnoĭ Toksikologii, pp. 41-47, Publisher "Nauka", Moscow. Translated by Robert M. Howland.

Aquatic toxicology cannot be developed as a science without the development of pathological morphology. In the future, it will be necessary to collect and correlate all data on pathological anatomy to spontaneous and experimental toxicoses in fish in order to utilize them as much as possible for differential diagnostics. It will be necessary to expand pathomorphological investigations considerably in the future, utilizing all methods of pathological anatomy for this. In all laboratories of aquatic toxicology it will be necessary to provide by official schedule a group of pathologo-anatomists comprising no less than three men. (Auth. conc.)

14432. Osadchiĭ, V. D., and P. N. Fedoseev (Kiev Technological Inst. of Light Industry, Kiev, USSR). 1969. DETERMINATION OF NITROGEN, SULPHUR AND HALOGENS IN ORGANIC SUBSTANCES. USE OF MAGNESIUM SILICIDE FOR DECOMPOSITION OF THE SAMPLE. (Novyĭ metod kolichestvennogo opredeleniya azota, sery i galogenov v organicheskikh veshchestvakh). Izvestiya Vysshikh Uchebnykh Zavedenii, Tekhnol. Legk. Prom. Vol. 6, Ministerstvo Vysshego i srednego Spetsial'nogo Obrazovaniya SSSR, 47-50. Translated by Robert M. Howland

It is proposed to use powdered magnesium silicide for the quantitative semimicro- and microdetermination of nitrogen, sulphur and halogens from one weighed portion of organic substance undergoing analysis. The method yields stable results. The absolute accuracy of determination lies within $\pm$ 0.30%. The method is reliable and simple and it can be recommended for application in different scientific research and production laboratories. (Authors conc.)

14433. Brown, James H. 1971. THE DESERT PUPFISH. Scientific American, 225(5): 104-110.

More than 20 populations of these hardy fish are found in tiny aquatic "islands" in the vicinity of Death Valley. Isolated for thousands of years, they have evolved into four distinct species.

14434. Samylin, A. F. (Petrozavodsk State Univ., USSR). 1970. THE ARISAL OF MALFORMATIONS IN THE EMBRYONAL DEVELOPMENT OF FISH UNDER THE INFLUENCE OF HEXACHLOROCYCLOHEXANE. (Vozniknovenie urodstv pri embrional'nom razvitii ryb pod vliyaniem geksakhlorana). Voprosy Vodnoi Toksikologii, publisher "Nauka", Moscow, 106-111. Translated by Robert M. Howland.

The most sensitive stages of the development of fish in regard to toxic substances are the start of gastrulation, the start of organogenesis, and transition to mixed feeding. These stages in development are most vulnerable during the early period of ontogeny with the influence of toxic substances. It is likely that the increase of changes in the embryo under the influence of toxic substances occurs starting from the moment of cleavage of the blastomeres. At small doses of substances the regulatory processes of development intensify according to the degree of complication of the embryo, about which one can judge by deviations in the structure of the blastula and the passage of gastrulation and the "correcting" of development in the majority of individuals during organogenesis. Retarded metabolic processes in the embryos in comparison with the larvae, fry and adults are probably one of the reasons why, at first glance, the spawn seems to be less sensitive to toxic substances. Small doses of a poison, which do not produce a rapid lethal outcome, with prolonged action from the start of formation of a new organism act depressively on metabolism. This can influence the hardiness of the organisms in the ensuing periods of development and lead to decline or complete disappearance of a particular species in a body of water. Use of the method of prolonged holding of fish at low concentrations, which seem harmless at first glance, with the utilization of physiological methods of investigation provides the possibility of establishing with more assurance the MPC of harmful substances for bodies of water, although these methods are rather laborious.

14435. Rawstron, Robert R. 1971. HARVEST AND SURVIVAL OF RAINBOW TROUT INFECTED WITH Sanguinicola davisi Wales. Calif. Fish Game 57(4): 253-256.

Rainbow trout, Salmo gairdneri, heavily infested with the blood fluke, Sanguinicola davisi, showed good annual harvest and survival rates, good growth, and a low cost to the angler's creel in an intermediate type of reservoir with few limnetic predators or competitors. (Auth.)

14436. Perret, William S., Barney B. Barrett, Walter R. Latapie, Judd F. Pollard, Woodrow R. Mock, Gerald B. Adkins, Wilson J. Gaidry, and Charles J. White. 1971. COOPERATIVE GULF OF MEXICO ESTUARINE INVENTORY AND STUDY, LOUISIANA. PHASE I, AREA DESCRIPTION AND PHASE IV, BIOLOGY. Louisiana Wild Life and Fisheries Commission, New Orleans, La., 175 p.

Tabular data are presented on water volume, vegetation, stream discharge, commercial fishery operations, coastal populations, pollution, filled areas, drained areas, and navigation channels in Louisiana's estuarine zone. Comparisons are made between past years' data and recent information. (Authors)

14437. Merriner, John V. (N. C. Coop. Fish. Unit, N. C. State Univ., Raleigh, North Carolina). 1971. DEVELOPMENT OF INTERGENERIC CENTRARCHID HYBRID EMBRYOS. Trans. Amer. Fish. Soc., 100(4): 611-618.

Development and time of death was studied in intergeneric centrarchid crosses between the fishes: Pomoxis nigromaculatus (Lesueur), black crappie; Chaenobryttus gulosus (Cuvier), warmouth; Lepomis macrochirus Rafinesque, bluegill; and Micropterus salmoides (Lacépède), largemouth bass. Hybridization experiments were conducted using artificial techniques of stripping, fertilization, and incubation. Fertilization, hatching percentages, and developmental data of hybrid crosses may be summarized in four categories: 1) High success reciprocally in Micropterus X Chaenobryttus; 2) Marginal success reciprocally in Pomoxis X Lepomis and Chaenobryttus X Pomoxis; 3) High success one-way in Micropterus ♀ X Lepomis ♂ and Chaenobryttus ♀ X Lepomis ♂; 4) Unsuccessful reciprocally in Micropterus X Pomoxis. Early development and emergence were found to be critical developmental periods. Photomicrographs of cross results are included. (Auth.)

14438. Hubbs, Clark, H. Bryan Sharp and Joel F. Schneider (The Univ. of Texas, Austin, Texas). 1971. DEVELOPMENTAL RATES OF Menidia audens WITH NOTES ON SALT TOLERANCE. Trans. Amer. Fish. Soc., 100(4): 603-610.

Fertilized eggs of Menidia audens were incubated at temperatures from 10.2 to 36.4 C, normal development occurred between 13.2 and 34.2 C, high survival was between 17.0 and 33.5 C, and optimal development seemed to be between 20 and 25 C. Cold lethality was associated with depletion of yolk supply prior to hatching. Eggs in 1/4 sea water did as well as those in fresh water; development through eye pigmentation was normal even in full strength sea water. Adults were more salt tolerant with critical salinities being near full sea water. (Authors)

14439. Lewis, William M. and Roy Heidinger (Fish. Res. Lab. and Dept. of Zool., Southern Ill. Univ., Carbondale, Illinois). 1971. SUPPLEMENTAL FEEDING OF HYBRID SUNFISH POPULATIONS. Trans. Amer. Fish. Soc., 100(4): 619-623.

When stocked at high densities in ponds and fed Purina Trout Chow, F_1 hybrids of male redear (Lepomis microlophus) X female green sunfish (L. cyanellus) used supplemental food poorly and growth was unsatisfactory. F_1 hybrids of male green sunfish X female bluegill (L. macrochirus) utilized supplemental food readily and produced populations that had high percentages of catchable fish at the end of the first year of feeding. Males of the latter hybrid grew at a significantly higher rate than did the females. Conversion values were comparable to those obtained in feeding channel catfish. (Authors)

14440. Stanley, Jon G., and Peter J. Colby (Univ. of Wisconsin-Milwaukee, Dept. of Zool. and Center for Great Lakes Study, Milwaukee, Wisconsin). 1971. EFFECTS OF TEMPERATURE ON ELECTROLYTE BALANCE AND OSMOREGULATION IN THE ALEWIFE (Alosa pseudoharengus) IN FRESH AND SEA WATER. Trans. Amer. Fish. Soc., 100(4): 624-638.

A study of the effects of temperature and salinity on ionoregulation in the alewife, Alosa pseudoharengus, revealed that concentrations of sodium, potassium, and calcium in plasma and muscle were similar in fish adapted to fresh water and those adapted to sea water. The non-stressed alewife is apparently an excellent ionoregulator in both environments. Acute exposure to cold caused a shift in plasma concentrations of sodium and calcium toward environmental concentrations, i. e., these ions decreased in fresh water and increased in sea water. An ionoregulatory failure due to cold is suggested. High temperatures had little effect on plasma electrolyte levels in fresh water whereas in sea water the concentrations of sodium, potassium, and calcium were elevated. Mortalities of the alewife in the Great Lakes may be caused by osmoregulatory failure induced by acute exposure to cold, but are probably not induced by exposure to elevated temperatures. Fish thermally acclimated in the laboratory or in Lake Michigan had essentially normal concentrations of blood electrolytes. In muscle, sodium was reduced during exposure to acute cold in both fresh water and sea water. The effect of warm water on ion levels in muscle was, in general, opposite that of cold. These data suggest shifts of ions or water between cellular and extracellular fluids of muscle. Such shifts might affect the function of excitable tissue. Muscle tremors and loss of equilibrium observed in dying alewives during summer mortalities might be brought about when sudden temperature drops (e.g., as a result of upwellings which are common occurrences in the Great Lakes) induce disturbances in cellular or extracellular concentrations of ions. In the laboratory, alewife mortalities caused by increasing or decreasing temperatures were about equal in fresh water and sea water. These findings suggest that salinity does not modify the capacity of alewives to tolerate acute temperature stress. (Authors)

14441. Lackey, Robert T., and Bruce E. May (Dept. of Fish. and Wildl. Biol., Colo. State Univ., Fort Collins, Colorado). 1971. USE OF SUGAR FLOTATION AND DYE TO SORT BENTHIC SAMPLES. Trans. Amer. Fish. Soc., 100(4): 794-797.

A solution of rose bengal and formalin is a good all around preservative for benthic samples. Sieved benthic samples can be preserved in this solution for long periods and then sorted by sugar flotation to obtain excellent results. (Authors conclusion)

14442. Lewis, Sue D. and William M. Lewis (Fish. Res. Lab. and Dept. of Zool., Southern Ill. Univ., Carbondale, Illinois). 1971. THE EFFECT OF ZINC AND COPPER ON THE OSMOLALITY OF BLOOD SERUM OF THE CHANNEL CATFISH, Ictalurus punctatus Rafinesque, AND GOLDEN SHINER, Notemigonus crysoleucas Mitchill. Trans. Amer. Fish. Soc., 100(4): 639-643.

A new, and possibly primary, effect of heavy metals on fishes is described. It is demonstrated that heavy metals so affect fishes as to cause a drop in the salt concentration in the blood serum. This change in the ionic content of the blood can cause the fish to become weakened, and pronounced change can be fatal. Salt changes in the blood were monitored by osmometry. The effects of both zinc and copper were evaluated. (Authors)

14443. Freeman, Robert A., and W. Harry Everhart (Dept. of Fish. and Wildl. Biol., Colo. State Univ., Fort Collins, Colorado). 1971. TOXICITY OF ALUMINUM HYDROXIDE COMPLEXES IN NEUTRAL AND BASIC MEDIA TO RAINBOW TROUT. Trans. Amer. Fish. Soc., 100(4): 644-658.

Toxic effects of aqueous aluminum complexes in neutral and basic media to rainbow trout fingerlings were investigated under constantly flowing, controlled conditions of concentration, pH, and temperature. Toxicities of various concentrations were highly pH dependent. Dissolved concentrations over 1.5 ppm aluminum caused drastic physiological and behavioral aberrations as well as acute mortality. Toxic effects of suspended aluminum, while they are more noticeable, at lower concentrations, are not as concentration dependent as those of dissolved forms. The safe concentration of either dissolved or suspended aluminum is well below 0.5 ppm. Mortalities among test animals ceased almost immediately after aluminum exposures were concluded. Recovery times for fish exposed to the various tests were proportional to the severity of the test conditions and to the length of exposure. Normal growth resumed almost immediately in fish from the less severe tests, and after a period of a few weeks in fish from the more severe tests. After up to four months recovery the average weight of fish surviving both chronically and acutely toxic aluminum concentrations is markedly below the control average. (Authors)

14444. Brungs, William A. (Environ. Protection Agency, Newtown Fish Toxicity Lab., 3411 Church St., Cincinnati, Ohio). 1971. CHRONIC EFFECTS OF CONSTANT ELEVATED TEMPERATURE ON THE FATHEAD MINNOW (Pimephales promelas Rafinesque). Trans. Amer. Fish. Soc., 100(4): 659-664.

A continuous, 12-month exposure of fathead minnows to elevated water temperature (26-34 C) showed that reproduction was more sensitive than survival, growth, or egg hatchability in assessing the effect of temperature. The number of eggs produced/female, the number of eggs/spawning, and the number of spawnings/female were each gradually reduced at successive temperatures above the control (23.5 C). No spawning or mortality occurred at 32 C which was the lowest temperature where growth was apparently reduced. Male secondary sexual characteristics were less developed at 30 C than at lower temperatures. (Auth.)

14445. Stickney, Robert R., and Bill A. Simco (Fish Farming Exp. Sta., Stuttgart, Arkansas). 1971. SALINITY TOLERANCE OF CATFISH HYBRIDS. Trans. Amer. Fish. Soc., 100(4): 790-792.

Determination of salinity tolerance in freshwater catfish is of interest since commercial production of these fish in brackish water may be attempted in the future. The salinity tolerance of several hybrid catfishes was examined at the Fish Farming Experimental Station during the summer of 1969. Fingerlings of the 1969 year class were used and included 3/4 blue: 1/4 channel, 3/4 channel: 1/4 blue, and 1/2 channel: 1/2 blue catfish hybrids. The medium used in these experiments was artificial seawater. Hybrids investigated in this study were able to tolerate salinities between 14 and 15 ppt for periods of 96 hours. They showed a similar salinity tolerance to that demonstrated by non-hybrid channel catfish fingerlings. It is suggested that these findings be verified under natural seawater conditions.

14446. Allen, Kenneth O., and Kirk Strawn (Dept. of Zool., Univ. of Arkansas, Fayetteville, Arkansas). 1971. RATE OF ACCLIMATION OF JUVENILE CHANNEL CATFISH, Ictalurus punctatus, TO HIGH TEMPERATURES. Trans. Amer. Fish. Soc., 100(4): 665-671.

Experiments were designed to determine the rate of temperature acclimation, measured in terms of change in heat resistance, when fish were changed between three temperatures - 26.0, 30.0, and 34.0 C. Approximately 2300 juvenile channel catfish, Ictalurus punctatus (Rafinesque), were tested. Fish acclimated to each of the three temperatures were exposed to each of the other two temperatures. The length of time required to acclimate to the new temperature was then monitored by testing samples of fish at 0, 1, 3, 9 hours, and then daily after the temperature change was made. Fish were tested at three lethal temperatures of 38.5, 39.0, and 40.0 C. Changes in average resistance time were used to determine progress toward acclimation. Fish changed from lower to higher temperatures were nearly reacclimated in 1 to 3 days. However, fish changed from higher to lower temperatures required from 4 to 14 days to approach acclimation to the new temperature. In both changes, complete reacclimation required at least 12 days. Acclimation was accelerated at higher temperatures. A strong cyclic effect in the mean daily resistance time was noted. A maximum or minimum in resistance time occurred about every 2 to 4 days. These oscillations in resistance time were tested by utilizing multiple regression analysis. The equations derived were found to be quartic ($P < .01$). No explanation was found for this rhythm. These findings indicate that tempering for a few hours would increase heat tolerance to some extent, but upwards of one day would be required to significantly increase heat tolerance. On the other hand channel catfish could be held in cold water for one or two days with only a partial loss of heat tolerance. Fish exposed to fluctuating temperature should retain a relatively high heat tolerance. (Authors)

14447. Hogan, James W. (Fish-Pesticide Res. Lab., Bur. Sport Fish. & Wildl., Columbia, Missouri). 1971. BRAIN ACETYLCHOLINESTERASE FROM CUTTHROAT TROUT. Trans. Amer. Fish. Soc., 100(4): 672-675.

Acetylcholinesterase (EC 3.1.1.7, acetylcholine acetyl-hydrolase) was studied in brain tissue from cutthroat trout, Salmo clarki. Utilizing a manometric technique the specific activity was determined to 18 μmoles acetylcholine hydrolyzed/mg protein per hour. Acetylcholine was found to be the optimum substrate with an optimum concentration of 10 mM. In addition, the effects of some cations and certain anticholinesterase agents were investigated. (Auth.)

14448. Jones, James H., Elizabeth B. Bullard and Aida Rodriguez (Dept. of Animal Biol., Lab. of Biochem., School of Vet. Med., Univ. of Pennsylvania, Philadelphia, Pennsylvania). 1971. THE ESSENTIAL NATURE OF VITAMIN A IN THE DIET OF GOLDFISH (Carassius auratus). Trans. Amer. Fish. Soc., 100(4): 676-681.

In an attempt to determine whether or not fish require dietary sources of vitamin A, commercially reared goldfish (Carassius auratus) were procured and maintained in a darkened animal room in glass tanks with continuously circulating, filtered water which was constantly aerated. The fish, divided into two groups, were fed synthetic diets: one of which, the control diet, contained crystalline retinol acetate; the other, the experimental, was the same diet but without the vitamin A acetate. Periodically a fish from one group or the other was sacrificed and the vitamin A of both liver and eyes determined. The carcasses were fixed in Bouin's fluid and preserved for histological study. The amount of vitamin A in the livers of the deficient fish decreased while that in the livers of the controls increased. At approximately the same time the deficient fish developed pathological signs such as hemorrhage into the eyes and other sites, exophthalmos, loss of scales, and anorexia followed by death. There was still considerable vitamin A in the eyes of the deficient fish. None of these signs appeared in the fish on the complete diet, and the amount of vitamin A in the tissue remained high. Without exception every fish showing pathological changes also developed a severe, generalized infection. On the other hand only one control fish became infected and that was very slight.

Similar results, but fewer in number, were obtained from preliminary experiments. These experiments demonstrate clearly that goldfish cannot synthesize vitamin A from ordinary dietary constituents. They also suggest that the vitamin deficiency increases the susceptibility of the fish to infectious agents. (Authors)

14449. Duchrow, Richard M., and W. Harry Everhart (Dept. of Fish. and Wildl. Biol., Colo. State Univ., Fort Collins, Colorado). 1971. TURBIDITY MEASUREMENT. Trans. Amer. Fish. Soc., 100(4): 682-690.

A quick and reliable method of measurement is necessary to set standard limits on the amount of suspended sediment to be tolerated in streams near land-use operations. Turbidity measurements may be useful if a major portion of the total turbidity is contributed by settleable solids, if a relationship exists between turbidity readings and weight per unit of volume of suspended sediment, and if a reliable meter is available. Water with turbidity readings greater than one JTU (Jackson Turbidity Unit) is generally composed mostly of settleable solids unless distorted by color. Non-filterable and total dissolved solids contribute variable amounts of light penetration reduction. Percentage contribution to turbidity of settleable solids is highly variable from sample to sample and from station to station. A high correlation exists between turbidity readings and weight for individual sediment types of suspension, but a poor relationship exists when sediment type is varied. Experiments conducted on the Hach model 2100, the Hellige, and the Jackson Candle turbidimeters resulted in a highly significant difference (α = 0.01) between readings on the same sample of suspended sediment. Turbidity is a questionable measure of suspended solids in water. A more accurate index would be suspended solids measured gravimetrically. (Authors)

14450. Anderson, Emory D., and Lloyd L. Smith, Jr. (Dept. of Entomology, Fish., and Wildl., Univ. of Minnesota, St. Paul, Minnesota). 1971. FACTORS AFFECTING ABUNDANCE OF LAKE HERRING (Coregonus artedii Lesueur) IN WESTERN LAKE SUPERIOR. Trans. Amer. Fish. Soc., 100(4): 691-707.

A field and laboratory study was conducted in 1965-1968 to investigate factors affecting lake herring (Coregonus artedii Lesueur) abundance in western Lake Superior. Commercial landings in November-December in the Duluth-Superior area dropped from 1,117,000 pounds in 1954 to 2000 pounds in 1966. Wisconsin catches also declined markedly. Abundance and fishing intensity indices decreased with landings. Commercial catches and abundance of chubs (Coregonus spp.) and smelt (Osmerus mordax) increased simultaneously with the herring reduction. Biological characteristics of Duluth-Superior and Apostle Islands (Wisconsin) herring stocks were examined and compared. Herring eggs were more abundant and viable in the latter area, and laboratory hatching success was significantly greater for Apostle Islands eggs. Herring larvae were generally more abundant and smaller in the Apostle Islands; distribution and growth did not differ between areas. Abundance of larvae in both areas declined sharply in June-July. Average age of adult herring in commercial catches increased from 3.9 years in 1950-1959 to 5.1 in 1966-1968 but showed no significant difference between areas. Percentage of females did not show a trend from 1960 to 1968; however, the 1968 percentage of 85.0 was the greatest since 1962. Percentage of females increased with age. Average length and weight increased from 11.3 inches and 0.33 pounds in 1950-1959 to 13.4 inches and 0.67 pounds in 1966-1968. Average number of eggs per ounce of fish increased from 842 in 1950-1954 to 1105 and 1019 in the Duluth-Superior and Apostle Islands areas, respectively, in 1966-1967. Smelt was the most abundant species in both areas and more abundant in Duluth-Superior. Zooplankton were more abundant at Duluth-Superior. Sediment soil in the Duluth-Superior area contained a higher percentage of silt and organic matter than soil in the Apostle Islands and was possibly related to lower egg viability in the former area. Correlations between fishing intensity and herring abundance suggest that overfishing was not the major factor in the decline of the species. Predation was not found to be a serious influence on herring. Food of herring, bloaters (Coregonus hoyi), and smelt was quite similar during early stages. Herring larvae consumed exclusively copepods. Food similarities and highly significant negative correlations between herring and bloater

abundance and herring and smelt abundance suggest that competition for food at the critical larval stage was likely the major influence in the lake herring decline. (Authors)

14451. Nicholson, William R. (NMFS, Mid-Atlantic Coastal Fish. Res. Center, Beaufort, North Carolina). 1971. COASTAL MOVEMENTS OF ATLANTIC MENHADEN AS INFERRED FROM CHANGES IN AGE AND LENGTH DISTRIBUTIONS. Trans. Amer. Fish. Soc., 100(4): 708-716.

Length frequency distributions of Atlantic menhaden, Brevoortia tyrannus, plotted by age, month, and latitude, support the hypothesis of an annual north-south movement. The majority of Atlantic menhaden, wintering in offshore waters south of Cape Hatteras, North Carolina, move northward in early spring. By about mid-June menhaden are distributed in coastal waters from Florida to Maine, their age and size increasing from south to north. A slow northward movement of fish north of False Cape, Virginia, continues throughout the summer. A southward movement, beginning in early September north of Cape Cod, Massachusetts and involving all fish north of False Cape by November, culminates in January when the majority of the population is again south of Cape Hatteras. (Auth.)

14452. Reed, Roger J. (Mass. Coop. Fish. Unit, Univ. of Mass., Amherst, Massachusetts). 1971. BIOLOGY OF THE FALLFISH, Semotilus corporalis (PISCES, CYPRINIDAE). Trans. Amer. Fish. Soc., 100(4): 717-725.

The biology of fallfish, Semotilus corporalis, was studied in Massachusetts. Back calculated age and growth data from eight different populations are compared. The computed TL-SR equation is $L = 18.00 + 1.010\ S$. Fish from the Quabbin Reservoir attained a maximum age of X+. Males attained sexual maturity when III+, females at IV+. Spawning occurred from late April to June when the water temperature reached 14.4 C. Unfertilized egg diameter is $2.16 \pm .09$ mm and the water hardened egg diameter $2.70 \pm .07$ mm. Eggs hatched 138-144 hours after fertilization in a constant water bath of 17.0 ± 0.5 C. Newly hatched larvae are $6.82 \pm .32$ mm TL. Early larval development and scale formation are described. The fecundity-weight relationship is $F + 159.1 + 26.4\ W$. Fallfish are omnivorous based on stomach content (algae, fish, aquatic and terrestrial insects, and crayfish). (Auth.)

14453. Davis, James R., and Darrell E. Louder (N. C. Wildl. Resources Comm., Raleigh, North Carolina). 1971. LIFE HISTORY AND ECOLOGY OF THE CYPRINID FISH Notropis petersoni IN NORTH CAROLINA WATERS. Trans. Amer. Fish. Soc., 100(4): 726-733.

This study was designed to expand the knowledge of the life history and ecology of Notropis petersoni Fowler. N. petersoni, commonly called the coastal shiner, is found along the Coastal Plains from North Carolina to Mississippi. In North Carolina its range is confined to a few streams in the lower Cape Fear River Basin, in the Waccamaw River, and in Lake Waccamaw. The food of the coastal shiner is principally crustaceans with plant material being taken incidental to feeding. Observation of N. petersoni in aquaria indicated that their diet depends on available food, however, they prefer zooplankton. The lotic population of N. petersoni appears to feed on the same type of material as the lentic populations. The pH range found in the habitat of N. petersoni was 5.3 to 6.9 with the minimum pH tolerance limit obtained for N. petersoni under laboratory conditions being 4.9. Dissolved oxygen ranged from 1.4 to 7.0 ppm under field conditions with a minimum tolerance limit of 0.9 ppm under laboratory conditions. The highest water temperature associated with N. petersoni was 84F in lotic environment and 89F in Lake Waccamaw. When water temperatures declined below 52F, N. petersoni moved to deeper water. Growth comparisons were made between lentic and lotic environments by the "t" test with the data indicating no significant difference between Lake Waccamaw, the lotic environment, and Livingston, Town, and Six Runs Creeks for age I and II fish. However, there was a significant difference between the Lake Waccamaw and the Northeast Cape Fear River populations. (Authors)

14454. Hergenrader, G. L., and Q. P. Bliss (Dept. of Zool., Univ. of Nebraska, Lincoln, Nebraska). 1971. THE WHITE PERCH IN NEBRASKA. Trans. Amer. Fish. Soc., 100(4): 734-738.

Sexually mature white perch (Morone americana), brought into Nebraska in the spring of 1964, spawned successfully in hatchery ponds. Some of the progeny were stocked in several of the highly alkaline lakes in the Nebraska Sandhills while others were inadvertently introduced into a turbid flood control reservoir in southeastern Nebraska. The species became established in the reservoir where it made very rapid growth and achieved sexual maturity one to two years sooner than in its natural range. Over a three year period the white perch completely displaced the native black bullhead as the dominant species in the reservoir. This dominance is being maintained and the white perch population is becoming stunted. During periods of reservoir discharge in the spring large numbers of white perch escape through the spillway. The stream on which the reservoir is located is tributary to the Platte River which subsequently joins the Missouri River. There appears to be no barrier to the movement of white perch through this stream system to the Missouri as they have been captured throughout the system up to a point only 18 stream miles from the juncture of the Platte and Missouri rivers. It appears likely that many white perch have successfully made the journey. The future prospects of the species in the Missouri River should be interesting. (Authors)

14455. Forney, John L. (Dept. of Conserv., Cornell Univ., Ithaca, New York). 1971. DEVELOPMENT OF DOMINANT YEAR CLASSES IN A YELLOW PERCH POPULATION. Trans. Amer. Fish. Soc., 100(4): 739-749.

Abundance of young-of-the-year yellow perch in Oneida Lake, New York was estimated in 1959 through 1968 by shore seining in July and trawling in late summer. Seine and trawl catches were high in 1960, 1962, 1964, and 1968 and catches of age I+ perch in subsequent years confirmed that these were dominant year classes. Variation in numerical size of year classes was less in the first year than in the second which indicated a divergence in year class abundance. Estimates of mortality based on the catch in trawls from August to October confirmed that weak year classes generally experienced higher mortality than strong year classes, thus mortality was depensatory. Changes in year class biomass and estimates of perch consumed by the walleye population were consistent with the assumption that depensatory mortality was caused by predation. (Auth.)

14456. Cairns, John, Jr., and Roger L. Kaesler (Dept. of Biol., Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. CLUSTER ANALYSIS OF FISH IN A PORTION OF THE UPPER POTOMAC RIVER. Trans. Amer. Fish. Soc., 100(4): 750-756.

A series of limnological surveys carried out from 1956 until 1965 were made in the vicinity of the Dickerson Plant of the Potomac Electric Power Company (located below the confluence of the Potomac and Monocacy Rivers) by the Limnology Department of the Academy of Natural Sciences of Philadelphia. These surveys were made at various stages of growth (i.e., increased generating capacity) of the power station and at both high and low water levels of the river. Cluster analyses were made of the fish data in order to provide a rapid and explicit means of analyzing the data, particularly relationships among aggregations of species. A secondary purpose was to measure the redundancy of information obtained by analysis of other groups, namely algae, protozoans, aquatic insects, and other invertebrates. On the basis of the cluster analysis of data on occurrence and distribution of fish, no changes in the environment of the Upper Potomac River can be ascribed to the operation of the Dickerson Plant of the Potomac Electric Power Company. This conclusion agrees with other results obtained by analyses of protozoan, algal, and insect species. Jaccard coefficients among aggregates of species of fish are appreciably higher than for other groups of organisms, indicating the relative mobility of fish compared to the other organisms. Comparing the fish data with that obtained for other groups of aquatic organisms indicated that there is much information redundancy when all groups of aquatic organisms are studied simultaneously. This redundancy is considered desirable since the results obtained with one group of organisms regarding pollution loads is much more significant if the same results are obtained with other groups of organisms. (Authors)

14457. Elrod, Joseph H. (Auburn Univ., Agric. Exp. Sta., Auburn, Alabama). 1971. DYNAMICS OF FISHES IN AN ALABAMA POND SUBJECTED TO INTENSIVE ANGLING. Trans. Amer. Fish. Soc., 100(4): 757-768.

Populations of largemouth bass (Micropterus salmoides), bluegill (Lepomis macrochirus), redear sunfish (Lepomis microlophus), channel catfish (Ictalurus punctatus), and white catfish (Ictalurus catus) in a 10.3 ha pond were observed for 2 years following removal of 314 kg/ha the first year of angling. Estimates of component species population parameters were made from fishing records, seine catches, a mark and recapture study, and a census of the fish recovered when the pond was drained. Fishing pressure ranged between 934 and 1509 angler hours per ha. Catch per angler hour declined from 208 g in 1963 to 137 g in 1965. Catches in the second and third years of fishing were 145 and 170 kg/ha, respectively. Decreased catches of bluegill, the dominant species in catches, were associated with a reduced growth rate that accompanied a high density of small bluegills. Addition of 25 adult largemouth bass per ha did not reduce abundance of the bluegills. Redear sunfish reproduction was negligible during the 2 years of high bluegill abundance. First-year growth of largemouth bass was related to abundance of bluegill fry, and year-class strength of bluegill was associated with abundance of young-of-year largemouth bass. Channel catfish reproduction was insufficient to sustain a fishable population, and angler return from restocking with fish 115 to 265 mm total length was low. White catfish maintained a small stock. Standardized seining appeared to be a reliable method for assessing relative abundance of bluegills and redear sunfish less than 140 mm total length and young-of-year largemouth bass. (Auth.)

14458. Goodnight, W. H., and T. C. Bjornn (Idaho Coop. Fish. Unit, Univ. of Idaho, Moscow, Idaho). 1971. FISH PRODUCTION IN TWO IDAHO STREAMS. Trans. Amer. Fish. Soc., 100(4): 769-780.

We estimated fish production (tissue elaboration) in two tributaries of the Salmon River in Idaho. Fish in Big Bprings Creek produced 11.8 g/m^2/yr and in the Lemhi River 13.6 g/m^2/yr. In Big Springs Creek juvenile rainbow-steelhead trout comprised most (84-95%) of the biomass present and contributed most of the production (88%). In the Lemhi River, however, a large population of unexploited whitefish made up most (60-80%) of the biomass but they contributed only 52% of the production. The desired yield from Big Springs Creek, an intensively managed stream, was steelhead trout smolts and the weight of the juvenile migrants was 34% of total production in the stream. In the Lemhi River, chinook salmon smolts were the primary desired yield and weight of smolts was probably less than 11% of total production. Virtually no yield was obtained from the whitefish population in the Lemhi River. (Authors)

14459. Kerby, Jerome Howard, V. G. Burrell, Jr., and C. E. Richards (Va. Inst. of Marine Science, Gloucester Point, Virginia). 1971. OCCURRENCE AND GROWTH OF STRIPED BASS X WHITE BASS HYBRIDS IN THE RAPPAHANNOCK RIVER, VIRGINIA. Trans. Amer. Fish. Soc., 100(4): 787-790.

During the period October, 1968-March, 1969, 99 hybrids were caught in a 20 nautical mile section of the Rappahannock River, Virginia. Since white bass have not been recorded from the Rappahannock River system, it is believed the hybrids escaped from a 50-acre impoundment (Miller's Pond) located on Camp A. P. Hill, a military reservation on the Rappahannock River about 30 nautical miles above Tappahannock. The hybrid more closely resembles the white bass than the striped bass in general body form. The hybrid is distinguished from the striped bass by a deeper body, a more arched back, and some interrupted lateral stripes. The most reliable distinguishing characteristics are scale rows above and below the lateral line. Age was determined from scales taken above the lateral line just posterior to the first dorsal fin. Ages supported the assumption that the hybrids were stocked as young Age 0 fish in 1967. Average fork length of hybrids 18 to 22 months of age (one annulus) collected in the fall, 1968, and in the spring, 1969, was 283 $\pm$ 4.25 mm (SE), and average weight was 362 g. Fish 30 to 31 months of age (two annuli) collected during November and December, 1969, averaged 421 $\pm$ 14.90 mm (SE) in fork length and weighed an average of 1,296 g. Back calculated

fork lengths averaged 124.2 mm at the first annulus and 276.2 mm at the second annulus. The growth rate of hybrids in the Rappahannock River appears to be somewhat less than that of hybrids in Cherokee Lake, Tennessee. (Authors)

14460. Jamsen, Gale C., and Paul V. Ellefson. 1971. MICHIGAN'S 1970 SPORT FISHERY, APRIL 25 - AUGUST 31. Mich. Dept. of Natural Resources Research and Development Report No. 234, 5 p. plus appendix.

Licensed fishermen numbering 665,000 spent a total of nearly nine million days fishing during Period II (April 25 - August 31). Three out of every four of these angler days occurred on a Michigan inland lake or stream. Thirty-seven percent of the fishermen aimed their efforts at the Great Lakes and their tributary streams while 83 percent fished on inland lakes and streams. Of those surveyed, 15 percent were non-residents. Most of the non-residents (90 percent) resided in Ohio, Indiana, Illinois, and Wisconsin. A summary of Michigan's sport fishing catch and effort is given for the period. (From authors survey results)

14461. Jamsen, Gale C., and Paul V. Ellefson. 1971. MICHIGAN'S 1970 SPORT FISHERY, SEPTEMBER 1 - DECEMBER 31. Mich. Dept. of Natural Resources Research and Development Report No. 235, 5 p. plus appendix.

Nearly 390,000 licensed fishermen generated a total of approximately 4.5 million angler days during Period III (September 1 - December 31). Two out of every three of these angler days occurred on a Michigan inland lake or stream. Forty-six percent of the fishermen actually exercising their right to fish aimed their efforts at the Great Lakes and their tributary streams while 70 percent fished on inland lakes and streams. Non-residents comprised 15 percent of the total who fished. Nearly all the non-residents (94 percent) resided in Ohio, Indiana, Illinois, and Wisconsin. A summary of Michigan's sport fishing catch and effort is given for the period. (From authors survey results)

14462. Cairns, John, Jr., Nancy H. Cromer, Timothy K. Bahns, and William T. Waller (Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. A CONFIRMATION OF MOUNT'S AUTOPSY TECHNIQUE FOR ZINC-CAUSED FISH MORTALITY. Water Resources Bulletin, 7(5): 956-968.

A total of 203 bluegill sunfish (Lepomis macrochirus, Rafinesque) which had been used in several acute zinc experiments carried out under varied environmental conditions were autopsied according to Mount's procedure for determining fish mortality due to zinc poisoning. Three classes of fish were used: those exposed to but not killed by zinc; those killed by zinc; and those not exposed to zinc. Two statistical tests were used to analyze these data and both tests gave results indicating significant differences ($\alpha = .05$) between all three classes of fish. This indicates that the Mount autopsy technique is very probably a valid generalization. The possibilities of using Mount's technique as a predictive tool are discussed. (Authors)

14463. Sorokin, Constantine (Dept. of Botany, Univ. of Maryland, College Park, Maryland). 1971. CALEFACTION AND PHYTOPLANKTON. BioScience, 21(23): 1153-1159.

In regard to phytoplanktonic organisms, surprisingly little is known about their tolerance to, and performance at, elevated temperatures. As a distinct biological group, green high-temperature algae have an optimum for their performance (growth) at about 38-39 C and can tolerate temperatures up to 43 C. The upper limit for the functioning of the low-temperature forms lies, indeed, near, or slightly above, 30 C and for the high-temperature forms it is in the vicinity of 45 C. Better high-temperature strains can be expected to outperform low-temperature organisms even within temperature limits suitable for the low-temperature forms. Rates of growth, photosynthesis, respiration and, possibly in general, enzyme activity may be higher in the most efficient high-temperature strains within the 20-30 C temperature range. Above 30 C, metabolic activity generally increases in the most competitive green high-temperature algae up to 38-39 C, while for the low-temperature forms these temperatures are fatal. Inasmuch as the increase in temperature of cooling water going through condensers of a power plant does not

generally exceed 10 C, the difference between the low- and high-temperature algae in regard to their capacity to withstand higher temperatures may be critical for the survival and normal functioning of phytoplanktonic organisms. Below 20 and even 15 C, the high-temperature forms can be expected to grow at a rate inferior to those of the low-temperature organisms. Occasional drop in temperature below 10-15 C will cause anabiosis in the high-temperature forms. However, with the passage of lower temperatures, the high-temperature algae are expected to resume their growth activity. The feasibility of stocking heated habitats with cultures of high-temperature algae, known for their efficiency and competing power, should not be overlooked. Indeed, this positive approach may prove to be the fastest, cheapest, and most efficient solution of the calefaction problem. For a good chance of success, this endeavor must be based on a possible wide assemblage of the high-temperature strains isolated from ecologically diverse habitats, selected for their adaptability and high performance, and maintained in a living condition to be available when such need arises. Breeding of other organisms, including fish, for the adaptability to elevated temperatures may prove to be a relatively simple problem compared to those already solved by breeders of economic plants and animals. For the cooler regions of the nation, stocking of waters, as the temperatures rise, with plants and animals adapted to elevated temperatures may prove to be a practical and long-lasting solution of the calefaction problem. It may even have an overall beneficial effect.

14464. Rich, Peter H., Robert G. Wetzel, and Nguyen Van Thuy (W. K. Kellogg Biol. Sta., Michigan). 1971. DISTRIBUTION, PRODUCTION AND ROLE OF AQUATIC MACROPHYTES IN A SOUTHERN MICHIGAN MARL LAKE. Freshwat. Biol., Vol. 1, pp. 3-21.

A typical marl lake of the Upper Great Lakes region has very few quantitatively important aquatic macrophytes. A detailed investigation of the spatial and seasonal distribution of macrophytic species and biomass showed that S. subterminalis strongly dominated the lake (79% of total biomass). S. subterminalis represented an almost pure stand (to 200 gm^{-2} mean annual ash-free dry weight) at all times of the year at intermediate depths of macrophytic growth (1-6 m). Two species of Chara (of eight varieties and forms) were present in significant quantities (12% of total biomass; to 100 gm^{-2}) but were severely limited to shallow depths and protected areas. Several annual submersed angiosperms were present, but only two species were quantitatively important. Potamogeton illinoensis Morong. and P. praelongus Wulfen formed brief summer peaks at 3 and 4-6 m, respectively. A striking feature of the seasonal biomass distribution of Scirpus subterminalis was the higher, viable biomass (to 150 gm^{-2}) throughout the winter under ice cover. Chara populations at 0-2 m also exhibited a relatively constant biomass throughout the year. Estimates of macrophytic productivity of perennial ('evergreen') species populations whose biomass remains relatively constant throughout the year were made employing several different methods of calculation and turnover factors. The low diversity but relatively high quantitative importance of macrophytes in marl lakes is attributed to an adverse dissolved inorganic and organic chemical milieu which inhibits phytoplanktonic production and allows only certain adapted macrophytes to develop strongly. (From authors summ.)

14465. Bachop, William, and John W. Price (Div. of Biol., Clemson Univ., Clemson, South Carolina). 1971. GIANT NUCLEI FORMATION IN THE YOLK SAC SYNCYTIUM OF THE MUSKELLUNGE, A BONY FISH (SALMONIFORMES: ESOCIDAE: Esox masquinongy). Journal of Morphology, 135(2): 239-246.

In muskellunge blastulae the yolk sac syncytium originally contains nuclei comparable in size to the blastomere nuclei from which the syncytial nuclei arose. By mitosis the originally diploid syncytial nuclei become numerous and crowded together. Continued synchronous mitosis of neighboring syncytial nuclei and the resultant crowding together of their spindles culminates in overlapping spindles, multipolar spindles, disorganized spindles, and the crowding together of large numbers of condensed chromosomes from contiguous spindles. When such an aggregation of condensed chromosomes becomes enclosed within one nuclear membrane, a giant nucleus appears in the following interphase. It soon becomes postmitotic. (Authors)

14466. Wigle, Donald T., and Gordon H. Dixon (Dept. of Biochem., Univ. of Brit. Columbia, Vancouver 8, British Columbia, Canada). 1971. A NEW HISTONE FROM TROUT TESTIS. J. biol. Chem., 246(18): 5636-5644.

A new histone has been isolated from testis cells of the rainbow trout (Salmo gairdnerii) and the initial characterization of this protein has been performed. This histone (forming about 0.5% of the total histones), was easily dissociated from purified chromatin either by chemical modification with maleic anhydride or by extraction at low salt or trichloroacetic acid concentrations. The histone was purified either by gel filtration on Bio-Gel P-10 eluted with 0.01 N HCl or by ion exchange chromatography on carboxymethylcellulose eluted with a linear gradient of lithium chloride. The molecular weight was determined to be 14, 500 by the mobility of the formylated derivative during sodium dodecyl sulfateacrylamide gel electrophoresis. Dansylation revealed proline to be the amino terminus and amino acid analyses showed the complete absence of 7 amino acids including the aromatic and sulfur-containing residues. Three amino acids, lysine, alanine, and proline, accounted for 60% of the residues in the protein. Peptide maps of the tryptic peptides of the histone showed 13 unique peptides and thus ruled out an origin by degradation of one of the major histones. The new histone resembles histone I in the high content of lysine and alanine but is more similar to histone IIb_2 in its molecular weight of 14, 500, a prolyl N terminus, and a lysine to arginine ratio of 3:1. Pending primary structural data which should reveal whether this histone should be classified as more similar to histone I or histone IIb_2, we propose to call it histone T (for trout). (Authors summ.)

14467. Marushige, Keiji, and Gordon H. Dixon (Dept. of Biochem., Univ. of Brit. Columbia, Vancouver, British Columbia, Canada). 1971. TRANSFORMATION OF TROUT TESTIS CHROMATIN. J. biol. Chem., 246(18): 5799-5805.

Nucleohistone is completely transformed into nucleoprotamine as a result of the replacement of histones by protamine during maturation of spermatids in rainbow trout. The chromatin isolated from the spermatids undergoing active chromosomal transformation has been fractionated into the nucleohistone and the nucleoprotamine portions. The latter has been found to contain a fraction of DNA, the histones of which have been partially replaced by protamine. Chemical characterization of these chromatin fractions as well as studies of their dissociation by salt and protamine added in vitro suggest that processes other than direct displacement of histones by protamine or by increased ionic strength are important in the biological displacement. The presence in the nucleoprotamine fraction of a highly heterogeneous series of basic protein fragments suggests that proteolysis places an important role in the removal of histones from the chromatin during the transformation process. (Authors summ.)

14468. Acton, Ronald T., Peter F. Weinheimer, Harry K. Dupree, Thomas R. Russell, Michael Wolcott, E. Edward Evans, Ralph E. Schrohenloher, and J. Claude Bennett (Univ. of Ala. in Birmingham, The Medical Center, Brimingham, Alabama). 1971. ISOLATION AND CHARACTERIZATION OF THE IMMUNE MACROGLOBULIN FROM THE PADDLEFISH, Polyodon spathula. J. biol. Chem., 246(22): 6760-6769.

The immune macroglobulin from the paddlefish, Polyodon spathula, was purified and characterized physicochemically. The macroglubulin had a sedimentation coefficient of 14.2 S and a molecular weight of 660, 000. Total reduction and alkylation in 7 M guanidine hydrochloride resulted in dissociation into heavy (H) and light (L) chains. The H and L chains were separated by gel filtration and found to have molecular weights of 58, 100 and 21, 000, respectively, employing sedimentation equilibrium in 5.0 M guanidine hydrochloride. Based on absorbance, equimolar quantities of the chains were recovered from the macroglobulin. These data are compatible with previously reported electron microscopic studies which demonstrated a tetrameric structure for the immune macroglobulin, and indicated that the structural subunit consists of two H and two L chains. Generally the amino acid composition was similar to mammalian IgM H and L chains. Although no NH_2-terminal group was detected in the light chain, the sequence of the first 5 residues from the NH_2-terminus of the H chain was found to be Asp-Val-Val-$\frac{\text{Val}}{\text{Leu}}$-Thr.

These data provide additional evidence for a structural similarity among phylogenetically distinct immune macroblobulins and suggest common evolutionary origin. (Authors summ.)

14469. Chien, Shih Ming (Dept. of Fish. and Allied Aquacul., Agric. Exp. Sta., Auburn Univ., Auburn, Alabama). 1971. DACTYLOGYRIDS FROM NORTH AMERICAN CYPRINIDS OF THE GENUS Nocomis. THE RECIPROCUS SPECIES GROUP. J. Parasit., 57(6): 1211-1214.

The monogenean genus Dactylogyrus parasitizing gills of the North American cyprinid fish genus Nocomis was studied comprehensively. D. reciprocus Rogers, 1967, was recovered from Nocomis leptocephalus bellicus, and for the first time from N. l. leptocephalus, N. l. interocularis, N. micropogon, N. platyrhynchus, and N. raneyi. Two new species are described: D. effusus sp. n. was taken only from N. effusus, and D. lachneri sp. n. from N. asper, N. biguttatus, and N. effusus. These three morphologically similar monogeneans are placed in the Reciprocus species group. (Auth.)

14470. Parker, John D., Richard D. Spall, and Mark C. Warner (Dept. of Zool. and Okla. Coop. Fish. Unit, Okla. State Univ., Stillwater, Oklahoma). 1971. TWO NEW MYXOSPORIDA, Henneguya gambusi sp. n. AND Myxosoma pharyngenus sp. n. IN THE MOSQUITOFISH, Gambusia affinis (Baird and Girard). J. Parasit., 57(6): 1297-1301.

Two new species of Myxosporida, Henneguya gambusi and Myxosoma pharyngeus, are reported from connective tissues of the integument and pharyngeal cavity, respectively, of the mosquitofish, Gambusia affinis. Immature and mature stages of the parasites are described and the nature of their infections are discussed. H. gambusi is monosporous or disporous while M. pharyngeus is principally disporous but monosporous and polysporous development is also thought to occur. Both species are reported as pathogenic. (Authors)

14471. Lom, Jiri, and Glenn L. Hoffman (Dept. of Biol. Sci., Univ. of Ill. at Chicago Circle, Chicago, Illinois). 1971. MORPHOLOGY OF THE SPORES OF Myxosoma cerebralis (Hofer, 1903) AND M. cartilaginis (Hoffman, Putz, and Dunbar, 1965). J. Parasit., 57(6): 1302-1308.

The spore of Myxosoma cerebralis is redescribed and compared with that of a close relative, M. cartilaginis. M. cerebralis is smaller, with greater variability in size and shape. It possesses a mucous envelope whereas M. cartilaginis does not. The surface architecture of M. cerebralis, as seen with the scanning electron microscope, differs in possessing a conspicuous circumsutural groove, prominent polar filament pores, and a mucus envelope. (Authors)

14472. Pennycuick, Linda (Dept. of Zool., Univ. of Bristol, Bristol, England). 1971. QUANTITATIVE EFFECTS OF THREE SPECIES OF PARASITES ON A POPULATION OF THREE-SPINED STICKLEBACKS, Gasterosteus aculeatus. Journal of Zoology, 165(2): 143-162.

The effects of Schistocephalus solidus, Diplostomum gasterostei and Echinorhynchus clavula on a population of three-spined sticklebacks from a pond in Somerset were studied. Schistocephalus was present at the highest level of infection and had the greatest effects on the sticklebacks. It caused the fish to weigh less than uninfected ones of the same length, as shown by the lower condition factor, and to grow more slowly; and it delayed the sexual maturation of fish of both sexes and prevented many from breeding. Diplostomum also had a significant effect on the condition of the sticklebacks and all three parasite species probably caused death or predation of heavily infected fish. The quantitative effects of the parasites on the condition, length and weight of the fish were calculated; seasonal changes in the condition factor could then be seen, and the growth rates for both length and weight calculated. (Auth.)

14473. Denton, E. J., W. R. A. Muntz, and D. P. M. Northmore (The Plymouth Lab. and the Lab. of Exp. Psychology, Univ. of Sussex, Brighton, England). 1971. THE DISTRIBUTION OF VISUAL PIGMENT WITHIN THE RETINA IN TWO TELEOSTS. J. Mar. Biol. Assoc. U.K., 51(4): 905-915.

The distribution of the visual pigments within the retina of the rudd, Scardinius erythrophthalmus, and dragonet, Callionymus lyra L., was studied by measuring the spectral absorbance of small areas of intact isolated retinas. The rudd retina contains two visual pigments, VP 507_1 and VP 535_2. There is a progressive change in the relative proportion of these two pigments in the dorso-ventral plane, and there are no sharply defined zones each with a different pigment mixture. The proportion of the A_1-based pigment (VP 507_1) is greater in the dorsal part of the retina. The maximal optical density of the pigment in the dorsal retina of the rudd was greater (about 0.6) than it was in the ventral retina (about 0.3). The difference in the amount of light absorbed, however, is small compared to the intensity difference between the upwelling and downwelling light of the environment. When the relative proportion of the A_1- and A_2-based pigments was changed by altering the lighting conditions under which the animals were kept there was little or no change in the maximal optical density of the pigment. In the dragonet the retina shows a clear division into a ventral pink zone (maximal optical density about 0.5) and a dorsal zone that is much paler (maximal optical density about 0.2). The relative spectral absorbance of the two regions is similar, although one is said to be a pure cone region, and the other to be dominated by rods. The spectral absorbance curves for the intact retinas agreed well with results obtained with pigment extracts. (Authors)

14474. Pentreath, R. J., and D. F. Jefferies (Ministry of Agric., Fish., and Food, Fish. Radiobiol. Lab., Hamilton Dock, Lowestoft, Suffolk, England). 1971. THE UPTAKE OF RADIONUCLIDES BY I-GROUP PLAICE (Pleuronectes platessa) OFF THE CUMBERLAND COAST, IRISH SEA. J. Mar. Biol. Assoc. U.K., 51(4): 963-976.

The accumulation of radionuclides by I-group plaice, Pleuronectes platessa L., in the vicinity of the pipe-line of the UKAEA plant at Windscale, Irish Sea, has been studied over a 7-month period. The principal isotope found in the flesh was ^{137}Cs, although ^{144}Ce, ^{106}Ru, and $^{95}Zr/^{95}Nb$ were also present in the gut contents. The ^{137}Cs flesh levels were examined in conjunction with the fluctuations of this nuclide in sea water, sediment and the gut contents. Of the three major dietary components found throughout the sampling period the calculated intake of ^{137}Cs from food appeared to fluctuate most closely with the Nephtys fraction of the diet, despite its relatively low ^{137}Cs content. (Authors)

14475. Wardle, C. S. (Marine Lab., Aberdeen, Scotland). 1971. NEW OBSERVATIONS ON THE LYMPH SYSTEM OF THE PLAICE Pleuronectes platessa AND OTHER TELEOSTS. J. Mar. Biol. Assoc. U.K., 51(4): 977-990.

The anatomy of the teleost lymph system is considered in relation to the observed flow of lymph. The plaice Pleuronectes platessa L. was studied. The vessels described by anatomists as longitudinal ventral, dorsal and lateral lymph ducts do not pass lymph to the head but act as collecting sinuses; the lymph flows from these sinuses to the neural lymph duct via the interspinal ducts. At the junction of each interspinal duct and the neural lymph duct there is a simple valve. Lymph drains through this system as a result of a negative pressure developed in the neural canal by the respiratory movements of the gill apparatus. The rigid nature of the neural lymph duct and the valves where the interspinal ducts join it allow the negative pressure to develop from a negative/positive gill generated pressure cycle in the cephalic lymph sinuses. Valves linking cephalic lymph sinuses aid the return of lymph to the duct of Cuvier using the same pressure cycles. The drainage system is different in the salmonidae where the neural lymph duct is degenerate and the network of peripheral ducts serve as lymph return ducts. This can probably be explained by the occurrence of higher circulation pressures in the salmonidae. Lymph from the neural lymph duct is a clear fluid having a composition similar to that of blood plasma. Like blood, lymph clots, and contains normal blood levels of mobile leucocytes and thrombocytes and lymph reflects blood levels of lactate. Lymph contains nearly no erythrocytes and the protein concentration

of neural duct lymph is 80.4 % that of blood plasma. ^{131}I iodinated human serum albumin (^{131}I HSA) passes from the vascular space and appears in the neural lymph canal at 80 % plasma levels. ^{51}Cr-labelled erythrocytes are limited to the vascular space. The volume of blood in plaice muscle and skin is normally 0.07-0.1 ml. per 100 g muscle and 0.4-0.7 ml. per 100 g skin. The ^{131}I-HSA-labelled extra vascular space (interpreted as lymph) measured 4-7 ml. per 100 g muscle and 60.74 ml. per 100 g skin. (Auth.)

14476. Murphy, Philip G., and Josette Vidril Murphy (Hopkins Mar. Sta. of Stanford Univ., Pacific Grove, California). 1971. CORRELATIONS BETWEEN RESPIRATION AND DIRECT UPTAKE OF DDT IN THE MOSQUITO FISH Gambusia affinis. Bull. of Environmental Contamination and Toxicology, 6(6): 581-588.

To measure the effect of temperature on DDT uptake by mosquito fish from water with a constant DDT-C^{14} concentration, continuous flow experiments were performed at 5°C and 20°C. Over the range measured, a nearly linear relation, with a slope of about 5 at 5°C and 6 or 7 at 20°C, exists between ng of DDT-C^{14} taken up and ml of oxygen consumed when water concentration of DDT is about 40 ppt. If DDT uptake rates are similarly related to metabolism in other species, caution must be used when predicting the contribution of direct uptake to DDT contamination in fish on the basis of experiments with one size class of fish because the slope of the log oxygen uptake rate-log relationship is considerably less than unity for all species studied.

14477. Hanek, George, and C. H. Fernando (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1971. MONOGENETIC TREMATODES FROM THE BAY OF QUINTE AREA, ONTARIO. II. GENUS Gyrodactylus Nordmann, 1832. Canad. J. Zool., 49(10): 1331-1341.

Five species of the subgenus Gyrodactylus (Mesonephrotus) Malmberg, 1964, namely G. stunkardi Kritsky and Mizelle, 1968, G. freemani n. sp., G. prolongis Hargis, 1955, G. atratuli Putz and Hoffman, 1963, G. avalonia Hanek and Threlfall, 1969, and seven species of the subgenus Gyrodactylus (Metanephrotus) Malmberg, 1964, namely Gyrodactylus etheostomae Wellborn and Rogers, 1967, G. eucaliae Ikezaki and Hoffman, 1957, G. macrochiri Hoffman and Putz, 1964, G. goerani n. sp., G. limi Wood and Mizelle, 1957, G. nebulosus Kritsky and Mizelle, 1968, and G. dechtiari n. sp., are described and figured from the fishes of the Bay of Quinte region, Ontario. (Authors)

14478. Symons, P. E. K. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. BEHAVIOURAL ADJUSTMENT OF POPULATION DENSITY TO AVAILABLE FOOD BY JUVENILE ATLANTIC SALMON. J. Anim. Ecol., 40(3): 569-587.

Fluctuations in abundance of food apparently had little immediate effect (within 20 days) on the density of territorially dominant salmon parr in a laboratory stream. The number of socially subordinate fish present at the periphery between territories of dominants, varied with food availability. Changes in sizes of dominants' territories with differing availability of food could not be demonstrated. The number of subordinates was reduced in areas of food scarcity chiefly by restriction on immigration by the increased aggression of dominant fish in conjunction with constant movement of parr from one home site to another (residence half-life 25 days or less). Eviction of subordinates and voluntary departure also contributed to reduction in numbers of fish where food was scarce. Between contiguous areas of food surplus and scarcity, population density could vary by a factor of about 1.5. A reversal in abundance of food between the two areas was followed by a stabilized reversal in population density about 15 days later. Even where food was abundant, the growth rate of subordinate parr was about two-thirds that of dominant parr. (Auth. summ.)

14479. Halsband, Egon and Inge (Bundesforschungsanstalt für Fischerei Inst. für Küsten- und Binnenfischerei). 1970. BIBLIOGRAPHY ON THE ELECTROFISHERY AND ITS PRINCIPLES, PART II. (Bibliographie über die Elektrofischerei und ihre Grundlagen Teil II). Arch. Fischwiss., 21(1): 1-72. In German.

14480. Hochachka, Peter W., David E. Schneider, and Thomas W. Moon (Dept. of Zool., Univ. of Brit. Columbia, Vancouver 8, British Columbia, Canada). 1971. THE ADAPTATION OF ENZYMES TO PRESSURE I. A COMPARISON OF TROUT LIVER FRUCTOSE DIPHOSPHATASE WITH THE HOMOLOGOUS ENZYME FROM AN OFF-SHORE BENTHIC FISH. Am. Zoologist, 11(3): 479-490.

At low temperature (3°C), in the absence of substrate and cofactor, trout liver fructose diphosphatase (FDPase) is inactivated by exposures to relatively low pressures. FDP and Mg^{2+} protect against this inactivation; hence, maximum catalysis at pH 7.5 is pressure insensitive, while at more alkaline pH, it is markedly accelerated by pressure. The volume change of activation, ΔV^*, at saturating FDP and Mg^{2+} concentrations is about -40 cm^3/mole. The apparent K_m for FDP and the K_a for Mg^{2+} are markedly increased by pressure. At low FDP or Mg^{2+} levels these kinetic properties outweigh ΔV^* in determining the reaction rate; hence, under these conditions, pressure retards catalysis. Similarly, the K_i for AMP is notably pressure sensitive. Comparable effects of pressure on the kinetic constants for liver FDPase from benthic Coryphaenoides are much less pronounced, suggesting that in these off-shore species enzyme-substrate, enzyme-cofactor, and enzyme-modulator interactions have been tailored through evolution for pressure independent catalytic function. (Authors synopsis)

14481. Whitt, Gregory S., and C. Ladd Prosser (Dept. of Zool., Univ. of Ill., Urbana, Illinois). 1971. LACTATE DEHYDROGENASE ISOZYMES, CYTOCHROME OXIDASE ACTIVITY, AND MUSCLE IONS OF THE RATTAIL (Coryphaenoides sp.). Am. Zoologist, 11(3): 503-511.

Investigations into the behavior of molecules in organisms occupying unique environments may provide a better insight into the functions of these same molecules in organisms from more common habitats. An organism well suited for such analyses is the rattail (Coryphaenoides sp.), a deep-sea teleost. The photoreceptor cells of the retina are predominantly rods. Although the lactate dehydrogenase A_4 and B_4 isozymes are present in this fish, the E_4 isozyme (found in the retina of many teleosts) is absent in the rattail retina. The rattails possess a lower cytochrome oxidase activity than shallow water fish. The sodium concentration is higher, and the potassium concentration lower in the rattail as compared with surface marine fish. The patterns of molecular synthesis and concentrations in the rattail may be related to such factors as light intensity, hydrostatic pressure, and temperature which exists in the deep-sea environment. (Authors synopsis)

14482. Hubbs, Clark (Dept. of Zool., The Univ. of Texas at Austin, Austin, Texas). 1971. SURVIVAL OF INTERGROUP PERCID HYBRIDS. Jap. J. Ichthyol., 18(2): 65-75.

Two hundred sixty-four intertribial percid hybrid tests were made among the Percini, Luciopercini and Etheostomatini. Only those between the Luciopercini and Etheostomatini (both reciprocals) fed, indicating a close phylogenetic relationship. A series of morphologic characters also support separating the Percini from the other two tribes of North American Percidae. (Auth.)

14483. Owen, John B., and Charles Wahtola, Jr. 1970. A PRELIMINARY REPORT ON AGE AND GROWTH OF A BLACK BULLHEAD POPULATION UNDER COMMERCIAL EXPLOITATION IN NORTH DAKOTA. Contribution from the Inst. for Ecological Studies, Univ. of No. Dakota, No. 2, 12 p.

Age and growth, length-weight, and condition factors were computed for a population of black bullheads, Ictalurus melas, Rafinesque, in Lake Ashtabula, a shallow reservoir of 5400 surface acres which has been fished commercially for bullheads since 1953. Annual rates of harvest were approximately 25 pounds of bullheads per acre per year. Linear growth was markedly superior to that reported in other lakes of comparable latitude. The mean condition factor "C" was 73.8 with a range of 30.4 to 134.4 for 168 fish of all sizes. The local sport fishery pressure on bullheads was negligible and the excellent growth and condition was attributed to sustained commercial harvest. (Authors)

14484. Hoyt, Robert D. (Biol. Dept., Western Ky. Univ., Bowling Green, Kentucky). 1971. AGE AND GROWTH OF THE SILVERJAW MINNOW, Ericymba buccata Cope, IN KENTUCKY. Amer. Midl. Nat., 86(2): 257-275.

Age and growth studies of the silverjaw minnow were based on 2324 specimens from Plum Creek and 1609 from other streams in Kentucky. The length-frequency method was employed in aging all fish and the scale method was used to verify the ages of fish from Plum Creek. The normal life span of the minnow is 3 years with a few individuals living into the 4th year. The greatest rate of growth in length of silverjaw minnows occurred in the first 2 years of life and the greatest rate of growth in weight occurred in the 2nd and 3rd years. The length-weight equation $W = aL^n$, or its logarithmic form $W = \log a + n \log TL$, was used to express the relationship between total length (TL) and total weight (W) of minnows from Plum Creek and other streams in Kentucky, and between males and females from Plum Creek. That same equation was used to show the relationship between total lengths and total weight less the gonads for fish from Stations I and II on Plum Creek, between males and females, and among specimens from Plum Creek taken during three different seasons. Silverjaw minnows from Plum Creek had a higher average coefficient of condition ($K = \frac{W \times 10^5}{TL^3}$) than those from other streams in Kentucky. Females had higher K values than males when gonads were included in the body weight, but males had higher condition values when the gonads were excluded. Fish from Station I and those collected during the spawning season had higher coefficients of condition than those collected at Station II and during other periods of the year respectively. Scales first appeared along the midlateral region of the caudal peduncle when the fish was about 13 mm long. Scalation was complete at a total length of approximately 27 mm. Development of fins was initiated before hatching and completed by a total length of 14 mm. The first fin to complete development was the caudal fin and the last was the pelvic. Differential growth rates of several morphometric characters were compared between different length groups of minnows. Head length and length of the pectoral and pelvic fins increased at a greater rate in smaller fish than in larger fish. Length of the caudal peduncle and total length increased at approximately the same rate in all length groups. (Auth.)

14485. Hastings, Robert W., and Ralph W. Yerger (Dept. of Biol. Sci., Fla. State Univ., Tallahassee, Florida). 1971. ECOLOGY AND LIFE HISTORY OF THE DIAMOND KILLIFISH, Adinia xenica (Jordan and Gilbert). Amer. Midl. Nat., 86(2): 276-291.

The diamond killifish, Adinia xenica, occurs in estuarine areas of the northern Gulf of Mexico from southeastern Florida to the central coast of Texas. It is most often found in shallow waters of medium salinity in areas of abundant vegetation, with other cyprinodontids and poeciliids normally expected in a brackish-water habitat. Adinia is prey to piscivorous birds and is parasitized by nematodes, trematodes and copepods. Defensive behavior includes darting to the bottom in deeper water or resting motionless in the shallowest water at the edges, usually in areas of abundant vegetation. There is little schooling tendency in Adinia although unorganized aggregations of individuals may form under certain conditions. A possible symbiotic relationship exists in which Adinia "tail-stands" to solicit cleaning behavior from other organisms. Food consists primarily of plant and animal material which is picked from submerged plant stalks or which falls into or floats on the surface of the water. Small crustaceans are the most common food item. Adinia attains sexual maturity at about 19 or 20 mm. Males outnumber females 2 to 1. Most, if not all, breeding activity occurs from March through August or September. Sexual dimorphism is always apparent; the males are larger and more compressed, have longer fins and brighter colors and possess contact organs. Eggs are deposited singly on the submerged stalks of plants. Males actively pursue females and combat often occurs between two males pursuing the same female. Eggs normally hatch in about 2 weeks. Newly hatched individuals are marked with dorsal, lateral, and ventral stripes of melanophores. Fin rays are well developed in the caudal and pectoral fins and may also be present in the anal fin fold. Scales and pelvic fins are visible after about 20 days. The adult body form is attained after about 30 days. (Authors)

14486. Nickerson, Max A., and James A. Hutchison (Div. of Biol. Sci., Ark. State Univ., State University, Arkansas). 1971. THE DISTRIBUTION OF THE FUNGUS Basidiobolus ranarum Eidam IN FISH, AMPHIBIANS AND REPTILES. Amer. Midl. Nat., 86(2): 500-502.

Three hundred fifty-seven specimens of fish, amphibians, and reptiles representing 59 taxa and a variety of ecological relationships were surveyed for the fungus Basidiobolus ranarum. B. ranarum was isolated from species occupying a broad range of ecological situations varying from totally aquatic to semiarboreal and subterranean forms. (Authors)

14487. Kalmijn, A. J. (Lab. of Comp. Physiol., Univ. of Utrecht, The Netherlands). 1971. THE ELECTRIC SENSE OF SHARKS AND RAYS. J. Exp. Biol., 55(2): 371-383.

Previous experiments have demonstrated that (a) the shark Scyliorhinus canicula and the ray Raja clavata are extremely sensitive to weak electric fields; (b) their electrical sensitivity is due to the ampullae of Lorenzini; (c) the sharks and rays can be stimulated by the bioelectric fields emanating from the flatfish Pleuronectes platessa. The object of the present study was to determine whether the sharks and rays use the bioelectric fields of the flatfish to detect the position of their prey. The experiments described demonstrate clearly that the shark Scyliorhinus canicula and the ray Raja clavata make a biologically significant use of their electrical sensitivity. Therefore, we now are justified in accrediting the animals with an electric sense and in designating the ampullae of Lorenzini as electroreceptors. Theoretically, the sharks and rays can detect the electric fields resulting from oceanic and tidal currents. Whether they make use of the available information for orientation in the open sea is not yet known. Furthermore, the observations and measurements described indicate that, in studying shark attacks, the electric fields of the prey and the electric sense of the predators should be taken into account. (From auth. summ.)

14488. Webb, P. W. (Dept. of Zool., Univ. of Bristol, Bristol, England). 1971. THE SWIMMING ENERGETICS OF TROUT. I. THRUST AND POWER OUTPUT AT CRUISING SPEEDS. J. Exp. Biol., 55(2): 489-520.

The wavelength, tail-beat frequency and trailing-edge amplitude have been measured for five groups of rainbow trout at various subfatigue cruising speeds. Four groups of fish were fitted with extra drag loads. The swimming mode was anguilliform by definition, but is probably best considered as intermediate between this and the carangiform mode. The wavelength of the propulsive wave represented 0.76 of the body length. The specific amplitude (amplitude/length) tended to reach a maximum value of 0·175 at tail-beat frequencies approaching 5/sec. The product of frequency and specific amplitude was found to be linearly related to swimming speed in all five groups of fish. The critical swimming speed for the non-loaded control group was 1.73 body length/sec, and fell in groups 1-4 as the magnitude of the extra drag loads increased. The critical swimming speed for the control group is low for salmonids, probably as a result of the unfavourable history of the fish. A method is described for calculating the drag of a swimming fish from the effects of the extra loads on the characteristics of the propulsive wave. It was found that thrust, $T = 7.9$ (swimming speed)$^{1.79}$. The thrust was approximately 2.8 times greater than that required for an equivalent straight rigid vehicle. It was calculated that the power output of the red muscle system would need to be about 0.48-0.77 ergs/sec/g muscle to overcome the drag of the fish at cruising speeds. The power output of the fish was compared with values calculated by means of mathematical models proposed by Taylor and Lighthill. It was found that the fish did not fit the assumptions made in Taylor's model, and so power output calculations were not comparable with those calculated in the present paper. Lighthill's model was found to give values which were within 5% of the values calculated here at higher swimming speeds. At lower swimming speeds the values were up to about 50% lower than expected because again the fish did not fit the assumptions involved. The relationship between thrust and swimming speed was extended into the sprint-speed range. It was calculated that fish could reach a

maximum sprint speed maintained for 1 sec, provided that drag was reduced by about a half, or that the power required was that to accelerate the fish to that speed. (Auth. summ.)

14489. Webb, P. W. (Dept. of Zool., Univ. of Bristol, Bristol, England). 1971. THE SWIMMING ENERGETICS OF TROUT. II. OXYGEN CONSUMPTION AND SWIMMING EFFICIENCY. J. Exp. Biol., 55(2): 521-540.

The oxygen consumption of rainbow trout was measured at a variety of sub-fatigue swimming speeds, at a temperature of 15°C. Five groups of fish were used, a control group and four groups with extra drag loads attached to the body. The logarithm of oxygen consumption was linearly related to swimming speed in all five groups, the slope of the relationship increasing with the size of the extra drag load. The mean standard rate of oxygen consumption was 72.5 mg O_2/kg wet weight/h. The active rate of oxygen consumption was highest for the control group (628 mg O_2/kg/h) and fell with increasing size of the attached drag load. The active rate for the control group was high in comparison with other salmonid fish, and in comparison with the value expected for the fish. This was not a result of the extra drag loads in the other groups. No explanation for this high value can be found. The critical swimming speed for a 60 min test period was 58.1 cm/sec (2.0 body lengths/sec) for the control group. The values for the critical swimming speeds were slightly higher than those measured for the same species in a previous paper (Webb, 1971). The difference between the two sets of critical swimming speeds is attributed to seasonal changes in swimming performance. The aerobic efficiency was found to reach values of 14.5-15.5% based on the energy released by aerobic metabolism in comparison with the calculated required thrust. The anaerobic contribution to the total energy budget in increasing-velocity tests is considered to be small, and can be neglected. It is concluded that the efficiency of the muscle system in cruising will be approximately 17-20% over the upper 80% of the cruising-speed range, while the caudal propeller efficiency will increase from about 15-75% over the same range. Consideration of the efficiency values for the caudal propeller calculated here, and those predicted by Lighthill's (1969) model of fish propulsion, suggest that the efficiency of the propeller system will reach an optimum value at the maximum cruising speeds of most fish, and will remain close to this value at spring speeds. (Auth. summ.)

14490. Jones, David R. (Dept. of Zool., Univ. of Br. Columbia, Vancouver 8, British Columbia, Canada). 1971. THE EFFECT OF HYPOXIA AND ANAEMIA ON THE SWIMMING PERFORMANCE OF RAINBOW TROUT (Salmo gairdneri). J. Exp. Biol., 55(2): 541-551.

A series of increasing water-velocity tests in a water tunnel has been used to investigate the maximum swimming performance of two groups of rainbow trout, one acclimated to high temperature (21-23°C) and the other to low temperature (8-10°C). At temperatures close to their acclimation temperatures there was no significant difference between the maximum swimming speeds of the two groups of trout. Exposure to an environmental oxygen tension of half the air-saturation value resulted in a 43% reduction in maximum swimming performance at low temperature and a 30% reduction at high temperature compared with normal animals. Reduction in haematocrit to one-half or one-third normal resulted in a 34% reduction in maximum swimming speed at low temperature and a 40% reduction at high temperature compared with control animals (blank injected). The results are discussed in terms of whether fish can be assumed to be in a steady state at all velocities below the critical velocity and whether it is possible to attribute the differences in performance, during anaemia and hypoxia, to increased metabolic cost of the cardiac and branchial pumps. (Auth. summ.)

14491. Cairns, John, Jr. (editor). 1971. THE STRUCTURE AND FUNCTION OF FRESH-WATER MICROBIAL COMMUNITIES. 301-page book available at $5.00 per copy. Checks should be made out to: Virginia Polytechnic Institute and State University and sent to: Mrs. Norma P. Douglass, Center for Environmental Studies, 1020 Derring Hall, Virginia Polytechnic Institute and State University, Blacksburg, Virginia 24061.

14492. Eisler, Ronald (Environ. Protection Agency, Natl. Marine Water Qual. Lab., West Kingston, Rhode Island). 1971. CADMIUM POISONING IN Fundulus heteroclitus (PISCES: CYPRINODONTIDAE) AND OTHER MARINE ORGANISMS. J. Fish. Res. Bd. Canada, 28(9): 1225-1234.

In acute toxicity bioassays with $CdCl_2 \cdot 2\frac{1}{2}H_2O$ at 20C and 20 ‰ salinity, the concentrations fatal to 50% of the organisms of various marine species in 96 hr ranged between 0.32 and 55.0 mg/liter Cd^{2+}. The order of sensitivity was: sand shrimp, Crangon septemspinosa (0.32); hermit crab, Pagurus longicarpus (0.32); grass shrimp, Palaemonetes vulgaris (0.42); common starfish, Asterias forbesi (0.82); common soft-shell clam, Mya arenaria (2.2); green crab, Carcinus maenus (4.1); Atlantic oyster drill, Urosalpinx cinerea (6.6); eastern mud snail, Nassarius obsoletus (10.5); sandworm, Nereis virens (11.0); striped killifish, Fundulus majalis (21.0); blue mussel, Mytilus edulis (25.0); sheepshead minnow, Cyprinodon variegatus (50.0); and mummichog, Fundulus heteroclitus (55.0). Mummichogs were more susceptible to cadmium exposures at 20C than at 5C and at 5 ‰ salinity than at 15, 25, or 35 ‰. Additional studies with mummichogs clearly demonstrated that 96 hr was not sufficient to adequately evaluate cadmium toxicity to this species. Mummichog whole body cadmium residues determined by atomic absorption provided a useful index of cadmium body burden among fish surviving exposure. However, cadmium residue data from dead mummichogs were of limited worth owing to accumulation after death. (Auth.)

14493. Lindsey, C. C., and M. Y. Ali (Inst. of Anim. Resource Ecol., Univ. of Brit. Columbia, Vancouver, British Columbia, Canada). 1971. AN EXPERIMENT WITH MEDAKA, Oryzias latipes, AND A CRITIQUE OF THE HYPOTHESIS THAT TELEOST EGG SIZE CONTROLS VERTEBRAL COUNT. J. Fish. Res. Bd. Canada, 28(9): 1235-1240.

In each of two sets of experiments, two female medaka, Oryzias latipes, that laid different-size eggs were crossed reciprocally with two males. Vertebral counts of the offspring differed significantly between batches, but there was no consistent correlation between egg size and vertebral count. Both the highest and lowest counts resulted from crosses with females laying large eggs. Other experiments are reviewed, and it is concluded that within the same race of fish there is no causal connection between vertebral number and egg size, although between different races or related species large adult size is often correlated with high vertebral count. The possible advantages of variation in vertebral number are discussed. (Authors)

14494. McArn, G. E., and S. R. Wellings (Univ. of Calif., Dept. of Pathology, Davis, California). 1971. A COMPARISON OF SKIN TUMORS IN THREE SPECIES OF FLOUNDERS. J. Fish. Res. Bd. Canada, 28(9): 1241-1251.

A study of the natural history of skin tumors occurring on two species of Pleuronectidae was conducted in the waters of Bellingham Bay, Washington. Twelve collections at monthly intervals indicated that 4.8% of 1977 English sole (Parophrys vetulus) and 2.4% of 2946 starry flounders (Platichthys stellatus) were tumorous. Three types of tumors were observed, and were classified as angioepithelial nodules, epidermal papillomas, or angioepithelial polyps, according to nomenclature previously established by other workers. The angioepithelial nodule was found on fish in the 1st year of life but not on fish older than 1 year. Epidermal papillomas usually occurred on fish that were 1 year or older, as did the angioepithelial polyps. The incidence of tumor-bearing fish, and the average number of tumors on a single specimen was greatest during the 1st year of life and decreased progressively in older age-groups. Tumors were more likely to occur on the pigmented side than on the nonpigmented side of the fish. The results of this study were compared and contrasted with a similar disease previously described on Hippoglossoides elassodon, the flathead sole. (Authors)

14495. Fujihara, M. P., and R. E. Nakatani (Dept. of Biol., Pacific Northwest Labs., Battelle Mem. Inst., Richland, Washington). 1971. ANTIBODY PRODUCTION AND IMMUNE RESPONSES OF RAINBOW TROUT AND COHO SALMON TO Chondrococcus columnaris. J. Fish. Res. Bd. Canada, 28(9): 1253-1258.

Active immunity to Chondrococcus columnaris disease was established in coho salmon (Oncorhynchus kisutch) approximately 3 months old by oral vaccination with heat-killed cells. Average agglutinating titers were 1:17 for control survivors and 1:168 for the orally vaccinated salmon. When rainbow trout (Salmo gairdneri) approximately 3 months old were exposed in a trough to C. columnaris present as a natural contaminant in Columbia River water, 52% of the fish died during the first 6 weeks of the test. Fish that survived the exposure were generally resistant to subsequent challenge. Many age 1+ rainbow trout that survived the C. columnaris infection as juveniles, when sampled after several months of reexposure to the disease, were immune carriers of the pathogen and developed agglutinating antibody titers ranging from 1:80 to 1:640. Titers up to 1:5120 were developed in disease-free yearling rainbow trout by parenteral vaccination. (Authors)

14496. Andrusak, H., and T. G. Northcote (Fish and Wildl. Branch, Br. Columbia Dept. of Recreation and Conservation, Victoria, Brit. Columbia, Canada). 1971. SEGREGATION BETWEEN ADULT CUTTHROAT TROUT (Salmo clarki) AND DOLLY VARDEN (Salvelinus malma) IN SMALL COASTAL BRITISH COLUMBIA LAKES. J. Fish. Res. Bd. Canada, 28(9): 1259-1268.

Comparison of spatial distributions and food of allopatric populations of cutthroat trout (Salmo clarki) and Dolly Varden (Salvelinus malma) in two lakes and of sympatric populations in a third lake suggested interactive segregation. Allopatric cutthroat changed their depth distribution throughout the spring and summer but no diel migration was noted. Changes in food habits closely corresponded to seasonal changes in vertical distribution. A wide range of food organisms was eaten from surface, midwater, and benthic sources. Allopatric Dolly Varden underwent diel changes in spatial distribution, with many being caught in onshore waters near the surface at night. They were absent from such areas in the day, apparently occupying offshore waters at greater depths. Their diet throughout summer consisted largely of surface insects and zooplankton, with lesser amounts of bottom fauna. Sympatric cutthroat trout and Dolly Varden were spatially segregated throughout the summer. Cutthroat trout occurred and fed mostly near the surface in littoral areas. In contrast, Dolly Varden were offshore and benthic in distribution and fed primarily on bottom organisms. By comparing distribution and food habits in allopatric and sympatric populations, it was suggested that competition for food may contribute to their segregation in sympatry. Although segregation of these species when cohabiting may involve interactive processes, the possibility of selective differences being of importance cannot be dismissed. (Authors)

14497. Thorne, Richard E. (Fish. Res. Inst., Coll. of Fish., Univ. of Wash., Seattle, Washington). 1971. INVESTIGATIONS INTO THE RELATION BETWEEN INTEGRATED ECHO VOLTAGE AND FISH DENSITY. J. Fish. Res. Bd. Canada, 28(9): 1269-1273.

An echo integrator, working in combination with an echo sounder, measures the total voltage of the fish echoes received from a given depth interval and sums these voltages over time. Investigations were made on the relation between integrated echo voltage and fish density for juvenile sockeye salmon (Oncorhynchus nerka) in Lake Washington and Pacific hake (Merluccius productus) and Pacific herring (Clupea harengus pallasi) in Puget Sound. When fish were distributed at densities at which they could be acoustically resolved as individual targets, the relation between net catch and integrated voltage was linear. At higher densities when the fish echoes were multiple targets, the net catch was related to the square of the integrated voltage. (Auth.)

14498. Zitko, V., B. J. Finlayson, D. J. Wildish, J. M. Anderson, and A. C. Kohler (Fish. Res. Bd. of Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. METHYLMERCURY IN FRESHWATER AND MARINE FISHES IN NEW BRUNSWICK, IN THE BAY OF FUNDY, AND ON THE NOVA SCOTIA BANKS. J. Fish. Res. Bd. Canada, 28(9): 1285-1291.

American eel (Anguilla rostrata), chain pickerel (Esox niger), white perch (Morone americana), yellow perch (Perca flavescens), brook trout (Salvelinus fontinalis), and Atlantic salmon (Salmo salar) contained 0.07-2.08, 0.27-1.58, 0.75-1.07, 0.20-1.05, 0.08-0.13, and 0.09 ppm of methylmercury, expressed as mercury on wet weight basis, respectively. With only two exceptions, levels of methylmercury in marine fish were below 0.13 ppm. Some of the freshwater sampling locations could be directly associated with an industrial activity in the area, whereas others suggested pollution by airborne mercury. However, the concentration of methylmercury in eels from a lake in New Brunswick did not change over a period of 46 years, indicating that elevated levels of mercury may in some instances reflect the natural situation. (Authors)

14499. Moose, Paul H., and John E. Ehrenberg (Marine Acoustics Program, Div. of Marine Resources and Applied Physics Lab., Univ. of Wash., Seattle, Washington). 1971. AN EXPRESSION FOR THE VARIANCE OF ABUNDANCE ESTIMATES USING A FISH ECHO INTEGRATOR. J. Fish. Res. Bd. Canada, 28(9): 1293-1301.

A mathematical model of the fish echo integrator, an acoustic device for measuring the abundance of pelagic fish, is presented. This model is analyzed and general expressions for the mean and variance of the integrator output are obtained. The integrator output can be scaled to provide an estimate of the total number of fish in the volume of water surveyed. The effect of each system parameter on the variance of the estimate is investigated and optimum operational procedures are suggested. (Authors)

14500. Scherer, E. (Fish. Res. Bd. of Canada Freshwater Inst., Winnipeg, Manitoba, Canada). 1971. EFFECTS OF OXYGEN DEPLETION AND OF CARBON DIOXIDE BUILDUP ON THE PHOTIC BEHAVIOR OF THE WALLEYE (Stizostedion vitreum vitreum). J. Fish. Res. Bd. Canada, 28(9): 1303-1307.

In laboratory experiments under overhead white light, walleyes (Stizostedion vitreum vitreum (Mitchill) displayed a negative phototactic response consistent with field observations and histological features of the walleye eye. The strength of this innate response proved to be largely dependent on the given respiratory situation: during oxygen depletion and during buildup of free carbon dioxide, this response diminished to the point of obliteration, which occurred at levels leaving mobility and equilibrium of the test specimens still intact. Whereas during the course of oxygen depletion a wide indifference zone (little or no change of light behavior) could be observed from saturation (= acclimation) level down to about 4-2 mg/liter, the fish reacted rather sensitively to increase of free carbon dioxide. Starting from acclimation levels of 1.0-2.0 mm Hg CO_2, the light avoidance response declined gradually while approaching tensions of 5 mm Hg or more, being completely abandoned at levels above 15 mm Hg. This effect could not be attributed to pH shifts. (Auth.)

14501. Dill, P. A. (Dept. of Zool., Univ. of Brit. Columbia, Vancouver, British Columbia, Canada). 1971. PERCEPTION OF POLARIZED LIGHT BY YEARLING SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 28(9): 1319-1322.

Food-conditioning experiments conducted in the laboratory demonstrated that groups of yearling sockeye salmon (Oncorhynchus nerka) can discriminate between vertical and horizontal planes of linearly polarized light. Removal of the adipose eyelid, a possible analyser of polarized light, did not abolish the response. The findings support the hypothesis that these fish can use polarization patterns for orientation during their seaward migration. (Auth.)

14502. Mackie, G. L., and S. U. Qadri (Dept. of Biol., Univ. of Ottawa, Ottawa, Ontario, Canada). 1971. A QUANTITATIVE SAMPLER FOR AQUATIC PHYTO-MACROFAUNA. J. Fish. Res. Bd. Canada, 28(9): 1322-1324.

A sampler was designed to quantitatively sample the invertebrates associated with submerged aquatic macrophytes. The advantage of this design over the previous ones is that it excludes benthic macrofauna. (Authors)

14503. Manohar, S. V., and Helen Boese (Fish. Res. Bd. of Canada Freshwater Inst., Winnipeg, Manitoba, Canada). 1971. POSTMORTEM CHANGES IN THE GLYCOGEN PHOSPHORYLASE ACTIVITY OF THE MUSCLE OF WHITE SUCKER (Catostomus commersoni) AND NORTHERN PIKE (Esox lucius). J. Fish. Res. Bd. Canada, 28(9): 1325-1326.

Glycogen phosphorylase "a" activity in the muscle of northern pike (Esox lucius) decreased during 7 days of storage at 0 C. Under similar conditions, activity of this enzyme increased in the muscle of white sucker (Catostomus commersoni). The total amount of phosphorylase "a" + phosphorylase "b" remained constant during storage for 7 days in both species. The reduced phosphorylase "a" activity in pike muscle may explain the slow degradation of glycogen in the muscle of this fish during storage as compared to that in white sucker. (Authors)

14504. Kutty, M. N., N. V. Karuppannan, M. Narayanan, and M. Peer Mohamed (Dept. of Biol. Sci., Madurai Univ., Madurai-2, Tamil Nadu, India). 1971. MAROS-SCHULEK TECHNIQUE FOR MEASUREMENT OF CARBON DIOXIDE PRODUCTION IN FISH AND RESPIRATORY QUOTIENT IN Tilapia mossambica. J. Fish. Res. Bd. Canada, 28(9): 1342-1344.

The technique used by Maros et al. (Anal. Chim. Acta 25: 390-399, 1961) for accurate measurements of total carbon dioxide in small samples has been modified for large samples of water, enabling measurement of carbon dioxide production by small aquatic animals. Data obtained from Tilapia mossambica by using the present technique are discussed. The method is considered to be adequate for obtaining reliable estimates of carbon dioxide production in fish. (Authors)

14505. Barraclough, W. E., and D. G. Robinson (Fish. Res. Bd. of Canada Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1971. ANOMALOUS OCCURRENCE OF CARP (Cyprinus carpio) IN THE MARINE ENVIRONMENT. J. Fish. Res. Bd. Canada, 28(9): 1345-1347.

Juvenile carp (Cyprinus carpio) were caught with a surface trawl in low salinity surface waters of the Strait of Georgia, British Columbia, during July 1967. A natural environmental route is established for the possible movement of carp from the Fraser River estuary to watersheds on Vancouver Island. (Authors)

14506. Sonstegard, R. A., and L. A. McDermott (Dept. of Microbiol., Univ. of Guelph, Guelph, Ontario, Canada). 1971. INFECTIOUS PANCREATIC NECROSIS OF SALMONIDS IN ONTARIO. J. Fish. Res. Bd. Canada, 28(9): 1350-1351.

Infectious pancreatic necrosis (IPN) virus was isolated from brook trout (Salvelinus fontinalis) in two hatcheries of the Ontario provincial salmonid hatchery system. No histories of abnormal mortalities suggestive of IPN infection had been reported at any of these hatcheries. (Authors)

14507. Patten, Benjamin G. (NMFS, No. Pacific Fish. Res. Center, Seattle, Washington). 1971. INCREASED PREDATION BY THE TORRENT SCULPIN, Cottus rhotheus, ON COHO SALMON FRY, Oncorhynchus kisutch, DURING MOONLIGHT NIGHTS. J. Fish. Res. Bd. Canada, 28(9): 1352-1354.

In stream aquaria, the percentages of coho salmon fry removed by the torrent sculpin averaged 70 in four tests on moonlight nights and 24 in seven tests on dark nights. (Auth.)

14508. Janicki, Ralph H., and William B. Kinter (Mt. Desert Island Biol. Lab., Salisbury Cove, Maine). 1971. DDT INHIBITS Na^+, K^+, Mg^{2+}-ATPase IN THE INTESTINAL MUCOSAE AND GILLS OF MARINE TELEOSTS. Nature New Biology, 233(39): 148-149.

Between 1 and 50 p.p.m. of DDT inhibited Na^+, K^+, Mg^{2+}-ATPase activity in the intestinal mucosae of the winter flounder (Pseudopleuronectes americanus) and the king O'Norway (Hemitripterus americanus). In both species, measurable inhibition was recorded at 1 p.p.m. and inhibition was linear through to 50 p.p.m. The Mg^{2+}-ATPase was unaffected by DDT, which inhibited Na^+, K^+, Mg^{2+}-ATPase in the intestinal mucosae of two other species. At a final DDT concentration of 50 p.p.m., inhibition was 37% in the yellow tail flounder (Limanda ferruginea) and 35% in the longhorned sculpin (Myoxocephalus octodecimspinosus). In this study, the mackerel (Scomber scombrus) was the only species in which the intestinal mucosal Na^+, K^+, Mg^{2+}-ATPase activity was resistant to 50 p.p.m. of DDT. The effect of DDT on ATPase activity in the gill of P. americanus also was examined. Basal Na^+, K^+, Mg^{2+}-ATPase activity in the gills of three fish treated with DMF (N, N-dimethylformamide) alone was 0.95 ± 0.09 μmol Pi/mg protein x h; but in the gills of three fish treated with DMF and 50 p.p.m., DDT (1.4×10^{-4} M) it was 0.44 ± 0.01 μmol Pi/mg protein x h. The inhibition was 54% ($P < 0.01$). At 50 p.p.m., DDT also inhibited 25% of the Mg^{2+}-ATPase.

14509. Maetz, J. (Groupe de Biologie Marine du Département de Biologie du Commissariat à l'Energie Atomique, Station Zoologique 06-Villefranche-sur-Mer, France). 1971. FISH GILLS: MECHANISMS OF SALT TRANSFER IN FRESH WATER AND SEA WATER. Phil. Trans. Roy. Soc. Lond., 262(842): 209-249.

The teleostean gill is a multi-purpose organ, specialized for respiratory gas exchanges, clearance of waste products of nitrogenous metabolism and maintenance of acid-base and mineral balances. Structural studies reveal a complex epithelium. The chloride-cells are almost certainly the site of ion exchange in relation to salt balance. Functional studies show that the gill is responsible for the net absorption of Na^+ and Cl^- occurring in fresh water and extrusion of these ions in sea water. In fresh water, a coupling between endogenous NH_4^+ or H^+ and HCO_3^- excretion and Na^+ and Cl^- absorption is observed. In sea water active Na^+ excretion is linked with K^+ absorption from the external medium. In parallel, active Cl^- excretion occurs. The gill is also the site of Na^+/Na^+ and Cl^-/Cl^- exchanges which involve 25 to 75% of the internal NaCl per hour. The relative importance of simple diffusion and exchange-diffusion in these exchanges is assessed. Biochemical studies reveal two enzymes playing important roles in the ionic pumps: carbonic anhydrase and Na-K activated ATPase. Studies involving transfer of euryhaline fishes from low to high salinity, show that the switch from freshwater to seawater types of gill function is far from instantaneous. Synthesis or destruction of functional sites and renewal of specialized cells are involved. The role of external or internal NaCl concentration changes as stimuli for these 'inductive processes' and the endocrine control of these functional changes are briefly discussed. (Auth.)

14510. Rafail, S. Z. (Inst. of Oceanog. and Fish.; Kayed Bey, Alexandria, Egypt). 1971. A NEW GROWTH MODEL FOR FISHES AND THE ESTIMATION OF OPTIMUM AGE OF FISH POPULATIONS. Marine Biology, 10(1): 13-21.

Evidence is presented that a simple power equation of the form $X_t - X_m = \pm b(|t - t_m|)^B$ can describe growth in length and weight of fishes, where X_t denotes fish length or weight at age t, X_m is length or weight (L_m or W_m) at a reference age t_m, and b and B are parameters to be estimated by the least squares. The optimum age of fish populations (t_y) may be estimated by the equation $MW_m/b = \pm y^B(B/y - M)$ where M denotes natural mortality and where $y = t_y - t_m$. (Auth.)

14511. Sprague, J. B., P. F. Elson, and J. R. Duffy (Dept. of Zool., Univ. of Guelph, Guelph, Ontario, Canada). 1971. DECREASE IN DDT RESIDUES IN YOUNG SALMON AFTER FOREST SPRAYING IN NEW BRUNSWICK. Environ. Pollut., 1(3): 191-203.

DDT residues were measured in Atlantic salmon parr (Salmo salar L.)

collected from streams which had been subjected to aerial forest spraying in preceding months or years. Six months after spraying, surviving salmon had averages of 0.5 to 2 ppm DDT in their whole bodies, and 2 to 4 ppm DDE. Slightly higher concentrations have been associated with declines in fisheries in other places. In 2.5 years or less after spraying, DDT decreased to low or undetectable concentrations. DDE, the common metabolite, decreased slowly during 12.5 years. The relation of total amount (y) in ppm, of all DDT residues, to the time (t) in years since the river was last sprayed, was simply described as $y = \frac{1.91}{t}$. Total residue showed little or no relation to other aspects of spray history, such as strength of DDT mixture applied, or total number of yearly sprayings received by the river. Salmon parr from a Nova Scotia river with no spray-history had undetectable or trace amounts of DDT residues, a relatively uncommon finding in recent years. (Authors)

14512. Tsuyuki, H., and A. P. Ronald (Fish. Res. Bd. of Canada, Vancouver 8, British Columbia, Canada). 1971. MOLECULAR BASIS FOR MULTIPLICITY OF PACIFIC SALMON HEMOGLOBINS: EVIDENCE FOR IN VIVO EXISTENCE OF MOLECULAR SPECIES WITH UP TO FOUR DIFFERENT POLYPEPTIDES. Comp. Biochem. Physiol., 39(3B): 503-522.

The seven major hemoglobin zones of Oncorhynchus nerka were designated together with their subunit structures, in parentheses, Hb_{Nerka} Sa($\alpha^{Ss}\alpha^{Sf}\beta_2^{Sf}$), Hb_{Nerka} Sb($\alpha^{Ss}\alpha^{Sf}\beta^{Ss}\beta Sf$), Hb_{Nerka} Sc($\alpha^{Ss}\alpha^{Sf}\beta_2^{Ss}$), Hb_{Nerka} Fa($\alpha_2^{F}\beta^{Fm}\beta^{Ff}$), Hb_{Nerka} Fb($\alpha_2^{F}\beta_2^{Ff}$), Hb_{Nerka} Fc($\alpha_2^{F}\beta^{Fs}\beta^{Ff}$), Hb_{Nerka} Fd($\alpha_2^{F}\beta_2^{Fs}$). At least eight structural genes code for the eight polypeptides involved. Juvenile O. nerka lacks polypeptide β^{Ss} and hence hemoglobin Hb_{Nerka} Sb and Hb_{Nerka} Sc but possesses an additional polypeptide β^{Fm} resulting in hemoglobin Hb_{Nerka}Fa. The heterozygous Hb_{Nerka}Fc is not only present in hemolysates near neutral pH, but also forms Hb_{Nerka}Fb and Hb_{Nerka}Fd in vitro at pH 8.5. No evidence of hybridization was found between the cathodal and anodal hemoglobins. The hemoglobins of O. keta, O. kisutch, O. gorbuscha, O. tshawytscha and Salmo gairdneri also consist of molecular species with up to 4 different polypeptides. (Authors)

14513. Denton, E. J., F. R. S. and M. F. Land (The Plymouth Lab. of the Mar. Biol. Assoc. of the United Kingdom, and Dept. of Physiol., Univ. College, London, England). 1971. MECHANISM OF REFLEXION IN SILVERY LAYERS OF FISH AND CEPHALOPODS. Proc. Roy. Soc. Lond. B, 178(1050): 43-61.

The highly reflecting structures found in the integuments and eyes of fish and cephalopods were studied. In all cases they consist of alternate layers of high and low refractive index (n) material (in fish, guanine and cytoplasm) and the high refractive index material is in the form of discrete plates. The highest reflectivity at a given wavelength λ_o, together with the widest waveband of high reflectivity, would be given if these alternate layers all had an optical thickness of $1/4\lambda_o$. We have examined the possibility that fish and cephalopods can make 'ideal' reflectors of this kind. The thicknesses (t) of the discrete plates released by scratching the reflecting layers were measured by interference microscopy, and it was found that although the plates from a region of a given colour sometimes varied greatly in surface area, their thicknesses were approximately constant. With one exception the optical thicknesses (nt) of the plates found in all the structures studied were between 100 and 200 nm. Many of the reflecting structures are highly coloured and in these there was almost always a good correlation between the wavebands best reflected and four times the optical thicknesses of the plates which they contained. The most ventral scales in the juvenile sprat were studied in some detail. At normal incidence these scales reflect best a waveband around 720 nm and the guanine crystals which they contain all have optical thicknesses close to one quarter of this wavelength. The changes in colour with angle of viewing, and with changes in osmotic concentration of the medium in which these scales are placed, support the idea that the spaces between the crystals are $1/4\lambda_o$ spaces. These scales have a high reflectivity to the lights penetrating best into the sea at the oblique angles of incidence from which the strongest intensities of daylight fall in life. Qualitative observations on scales from herring and from other regions on the sprat supported

the hypothesis that their guanine crystals were also arranged approximately in $1/4\lambda_o$ stacks. Similar conclusions were reached for coloured surfaces found in the skin of the horse mackerel, the iris of the neon tetra, the reflecting tapeta of the dogfish and the spurdog, and in the eye of the squid, Loligo forbesi. In the scales of the roach, Rutilus rutilus, the crystals are of thicknesses which indicate that if in 'ideal' $1/4\lambda_o$ stacks they would at normal incidence appear red and at oblique incidence green, whilst in fact they are very little coloured. The crystals from the eyes of Callionymus lyra had 4nt around 300 nm (in the u.v.) yet the reflexions given by piles of these crystals were bronze coloured. Possible explanations of these facts are given. In cephalopods the high refractive index plates are lozenge-shaped, flexible and of refractive index about 1.56. (Authors)

14514. Sabodash, V. M. (Inst. of Hydrobiol., AS UKSSR, Kiev, USSR). 1970. DYNAMICS OF ZINC CONCENTRATION IN THE EARLY DEVELOPMENTAL STAGES OF CARP. Hydrobiological Journal, 6(3): 59-65.

The initial zinc content of roe from adults of different ages varies. It is highest in the roe of 3-year-olds (47.5 mg/100 g of dry substance on the average), lower in the roe of 6- to 7-year-old fish (29.0 mg/100 g on the average), still lower in the roe of 11- to 14-year-old fish (16.5 mg/100 g on the average). Consequently, the initial amount of zinc in mature roe clearly decreases as the adults age. The stage-by-stage dynamics of the zinc content in embryos and early larvae from fish of different ages exhibited its own specific pattern in the control. The amount of zinc in developing roe from young adults between the time of fertilization and the end of the gastrula decreased sharply to 20 to 23 mg/100 g of dry substance, after which (from the C_1 to D_2 stage until the end of the experiment) it tended to accumulate slightly in the larvae. This stage-by-stage variability in the zinc content of developing roe and larvae from middle-aged fish was the same as that in the offspring of the youngest fish, but the tendency for it to accumulate in the larvae was manifested somewhat sooner (as early as stage B) and to a greater degree. Unlike the offspring of young and middle-aged fish, the zinc content of the embryos from the oldest fish in the period from fertilization to the end of the gastrula did not drop, in fact, it rose from 16.5 to 21.5 mg/100 g of dry substance, remained more or less constant until hatching, increased fairly sharply by stage B, remained at about the same level until stage C_2, after which it decreased slightly until the end of growth (stage D_1). Thus, the original amount of zinc inherited by mature oocytes from the parents influenced the dynamics of elimination and accumulation of this element in carp in the embryonic and early postembryonic periods of development. This feature of the stage-by-stage variability in the zinc content of carp embryos and larvae was also completely confirmed by the experiments performed to determine the effect of the addition of $ZnSO_4$ (5 mg/liter) on carp roe and larvae. (Auth. conclusions)

14515. Matey, V. E. (Inst. of Biol. of Inland Waters, AS USSR, Borok, USSR). 1970. EFFECT OF SUBTOXIC PHENOL CONCENTRATIONS ON THE CONDITIONED-REFLEX ACTIVITY OF GUPPIES. Hydrobiological Journal, 6(3): 84-86.

A phenol concentration of 3.12 mg/l stimulated slightly the conditioned-reflex activity of the fish. A slight inhibition of the conditioned-reflex activity was observed in guppies placed into a phenol solution with a concentration of 4.68 mg/l. Phenol in a concentration of 6.25 mg/l caused even more extensive changes in the higher nervous activity of the fish. Action of phenol in a concentration of 12.5 mg/l suppressed all nervous processes in the organism of guppies to such an extent that no clear-cut positive group conditioned reflexes could be produced. It can be concluded from the data that the conditioned-reflex method can be successfully used to study the effect of toxic agents on the higher nervous activity of fish.

14516. Gayduk, V. V., and A. G. Poddubnyy (Inst. of the Biol. of Inland Waters, AS USSR, Borok, USSR). 1970. AN INSTRUMENT (HYDROCAPPAMETER) FOR FIELD MEASUREMENTS OF THE CONDUCTIVITY, TEMPERATURE AND ILLUMINATION OF WATER. Hydrobiological Journal, 6(6): 96-99.

14517. Flerov, B. A. (Inst. of Biol. of Inland Waters, AS USSR, Borok, USSR). 1970. STUDY OF THE ADAPTATION OF GUPPIES TO PHENOL. Hydrobiological Journal, 6(3): 87-89.

Exposure experiments showed that guppies do not adapt to subtoxic concentrations of phenol. Even prolonged exposure did not have any effect at all on the results of the experiment. Apparently, a selection mechanism exists in fish whereby their resistance to toxic agents is modified; experiments should be carried out in this direction. The lack of any adaptation to phenol in guppies raises the hope that when permissible concentrations are established for certain organic toxic agents, it will apparently not be necessary to introduce a correction for the adaptation effect.

14518. Davydov, O. N. (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. MAINTENANCE OF PARASITIC WORMS OF FISH ON SYNTHETIC MEDIA. Hydrobiological Journal, 6(3): 104-106.

Parasitic worms of fish survive longest under artificial conditions when cultivated in a medium consisting of a mixture of Locke-Ringer's solution with fish broth at +5°. These worms are quite tolerant of low temperatures.

14519. Nazarenko, K. T. (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. EXPERIMENTS WITH INCUBATION OF PIKE PERCH SPAWN ON ARTIFICIAL SPAWNING GROUNDS OF THE NEST TYPE OUT OF WATER. Hydrobiological Journal, 6(3): 106-108.

Artificial spawning grounds of the nest type as designed by N. D. Biliy are an important means of cultivating gamefishes. The methods of incubating spawn in a moist atmosphere were modified and applied in a simple form to artificial spawning grounds of the nest type. Nests were taken from a reservoir and transferred to a dugout where they were immersed for 5 to 10 secs with potassium permanganate solution (1:20, 000) and then suspended on a wooden plank 1m above the floor. They were irrigated every 4 hrs for 5-10 secs with potassium permanganate solution throughout the 3-4 day incubation period. Nests with hatching embryos were transferred to the reservoir. The experiments showed that the survival rate of spawn on nests irrigated with the potassium permanganate solution was in fact much higher than in the control, due to suppression of the development of putrefactive microflora and fungus on incubating spawn.

14520. Zhukinskiy, V. N., and R. I. Gosh (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. VIABILITY OF EMBRYOS IN RELATION TO INTENSITY OF RESPIRATION OF OVULATED SPAWN FROM ROACH AND BREAM OF DIFFERENT AGES. Hydrobiological Journal, 6(4): 46-55.

The intensity of respiration of ovulated roach spawn was shown to decrease steadily when kept for 8 hours at 20°C in a moist atmosphere. This index is related to the age of the females. The viability of spawn and hardiness of the embryos vary with the intensity of respiration of the ovulated spawn. A similar relationship was also found in bream spawn.

14521. Uskova, Ye. T., A. V. Chaykovskaya, D. A. Ustimovich, and S. I. Davidenko (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. CHEMICAL COMPOSITION OF MUCUS FROM THE SKIN OF SOME SPECIES OF BLACK SEA FISHES. Hydrobiological Journal, 6(4): 71-75.

The content of reactive protein rises in the mucus of marine fish skin with increasing speed of locomotion. There is no relationship between the glucoprotein content and the speed of the fish. The content of high-molecular proteins increases with increasing speed of locomotion. The hydrodynamic properties of fish skin mucus are apparently determined by the presence of protein with high reactivity. The molecular weight of this protein must not be less than 50, 000.

14522. Dyachuk, I. Ye. (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. SOME CHARACTERISTICS OF THE LINEAR GROWTH OF BREAM IN THE KAKHOVKA RESERVOIR AND THE "CHUGUNOVA" PARADOX. Hydrobiological Journal, 6(4): 60-66.

The phenomenon known as the growth "paradox" or the Lee antiphenomenon was found to have developed in the Khakova reservoir bream under the influence of certain environmental conditions.

14523. Danilenko, T. P. (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. DYNAMICS OF GLYCOGEN IN THE EARLY STAGES OF EMBRYOGENESIS IN Carassius auratus (L.) Hydrobiological Journal, 6(4): 66-70.

The synthesis and utilization of glycogen varies in intensity in the early stages of embryogenesis in Carassius auratus. The substance accumulates during the formation of the perivitelline space and in the early stage of division and gastrulation. Completion of division, growth of blastula, and start of embryo formation are accompanied by a substantial decrease in the amount of glycogen in the embryo.

14524. Arsan, O. M. (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. THIAMINASE ACTIVITY IN THE LIVER AND INTESTINE OF SOME FRESHWATER FISHES. Hydrobiological Journal, 6(4): 75-77.

Fishes from Kremenchug Reservoir were analyzed for thiaminase activity in summer and fall. During summer, thiaminase activity was highest in the liver and intestine of the perch. It was lower in the same organs and tissues of the roach and it was about the same in the liver of the rudd and bream. In the fall, enzymatic activity in the liver and intestine of all the fishes studied was lower than in the summer. Thiaminase activity in fish organs and tissues varies with the species and influence of seasonal factors.

14525. Mel'nichuk, G. L. (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. FOOD REQUIREMENTS AND ENERGY BALANCE OF JUVENILE WILD CARP IN KREMENCHUG RESERVOIR. Hydrobiological Journal, 6(5): 40-46.

Application of an equation derived by the author for the average level of metabolism made it possible to calculate the energy consumed in metabolism and the food requirements of juvenile carp under different feeding and growth conditions in the Kremenchug Reservoir.

14526. Lyashenko, A. F., and N. G. Ivanyukov (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. THE POPULATION OF JUVENILE FISH AND SUFFOCATION OF THESE FISH IN SHALLOW AREAS OF KREMENCHUG RESERVOIR AS A RESULT OF "BLOOMING" OF THE WATER. Hydrobiological Journal, 6(5): 47-53.

It has been demonstrated that growing blue-green algae do not have a deleterious effect on the size of the population of juvenile fish. Greatest numbers of young perch and pike-perch in shallow areas of the reservoir were observed at moderate growth of the algae (concentrations up to 200-250 g/m^3). However, death and decomposition of the algae in areas of their concentration in shallow water caused local conditions of oxygen deficiency, resulting in massive death of young fish. Fourteen species were identified among the young fish (fingerlings) killed as a result of oxygen deficiency in the lower sector of the Kremenchug Reservoir. Commonest among them were Percidae (perch, pike-perch, and ruffe) and Cyprinidae (ide).

14527. Benzhitskiy, A. G., L. G. Gutveyb, and M. N. Lebedeva (Inst. of the Biol. of So. Seas, AS UkSSR, Sevastopol', USSR). 1970. SYNTHESIS OF COBALAMINS BY BACTERIA ISOLATED FROM THE DIGESTIVE ORGANS OF BLACK SEA FISH. Hydrobiological Journal, 6(5): 61-63.

Six out of eight strains of bacteria showed a higher productivity on the medium containing unirradiated sea water. The microflora in the digestive organs of our Black Sea fishes which have different feeding habits and modes of life, shows the ability to manufacture cobalamins and apparently can be one of the sources of these compounds to the fish. The microflora of the digestive organs of bottom fishes in the Black Sea shows the widest variety of strains.

14528. Kudrinskaya, O. I. (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. THE INFLUENCE OF THE CONCENTRATION OF FOOD ORGANISMS ON THE RATE OF THEIR CONSUMPTION BY FISH LARVAE. Hydrobiological Journal, 6(5): 64-67.

Upon ascertaining parameters through use of the formula $CI_r = CI_R (1-10^{-px})$, one can calculate the actual indexes of food consumption on the basis of the concentration of zooplankton, and those indexes are important for the evaluation of the food supply of fish larvae under various feeding conditions.

14529. Somkina, N. V. (St. Univ. of Rostov on Don, USSR). 1970. HISTIDINE-CONTAINING PEPTIDE IN THE BRAIN OF THE STURGEON AND PIKE-PERCH IN DIFFERENT PERIODS OF POSTEMBRYONIC LIFE. Hydrobiological Journal, 6(5): 72-73.

The post-embryonic period of development of the sturgeon and the pike-perch is characterized by a change in the concentration of histidine-containing peptide in the brain of both species. The maximum quantity of the compound is detected in the brain of the sturgeon at two months of age (5.39 micromoles per gram of tissue) and at one year in the pike-perch (11.8 micromoles per gram). As development continues, the concentration of the peptide in the brain of the sturgeon and the pikeperch gradually declines, so that at the age of sexual maturity the content is 2.8 micromoles per gram of tissue in the former and 5.5 micromoles per gram in the latter.

14530. Galasun, P. T., K. I. Ben'do, and M. A. Bulatovich (Ukr. Fish. Res. Inst., Kiev, USSR). 1970. HYDROBIOLOGICAL DESCRIPTION OF TROUT PONDS IN THE WESTERN REGIONS OF THE UKRAINIAN SSR. Hydrobiological Journal, 6(5): 74-79.

The ponds of the trout farms under consideration show hydrologic and temperature differences owing to the source of supply. The ponds on the farms studied are classed as cold-water oligotrophic and oligosaprobic bodies of water. Phytoplankton and zooplankton are poorly developed. The biomass of zoobenthos in ponds on farms taking their water from springs and artesian wells is higher than on farms fed by waters from mountain rivers. Of the Carpathian farms, the highest biomass of zoobenthos is found on the Zhdymir Farm.

14531. Lazareva, L. P. (Dagestan Div. of Casp. Inst. of Fish., Makhachkala, USSR). 1970. ZOOPLANKTON OF NURSERY AND FEEDING PONDS OF UYTASH FISH HATCHERY. Hydrobiological Journal, 6(5): 88-91.

Ponds studied at the Uytash fish hatchery are extremely poor in zooplankton. According to the classification of G. G. Vinberg and V. P. Lyakhnovich, the waters under study here belong to the category of ponds with a low biomass of zooplankton (not more than 10 g/m^3, as a seasonal average), and in the case of one pond, even among ponds with very low biomass (less than 1 g/m^3).

14532. Lezina, A. N. (Dagestan Br., Casp. Inst. of Fish., Makhachkala, USSR). 1970. NUTRITION AND GROWTH OF FINGERLING CARP IN NURSERY PONDS OF UYTASH FISH HATCHERY. Hydrobiological Journal, 6(5): 92-95.

The low natural productivity and high population density of carp are responsible for the low fish productivity of the ponds, the poor record of individual weights, and the appreciable waste of fish even under favorable temperature conditions and a prolonged growing season. In order to increase the fish productivity, the percent yield, and the individual weight of the fingerling carp under the conditions of the Uytash fish hatchery, the optimum density of the fish population in the nursery ponds should not exceed 50,000 per hectare.

14533. Fabacher, David L., and Howard Chambers (Dept. of Entomol., Miss. St. Univ., State College, Mississippi). 1971. A POSSIBLE MECHANISM OF INSECTICIDE RESISTANCE IN MOSQUITOFISH. Bull. Environmental Contamination and Toxicology, 6(4): 372-376.

This study compares the percent lipid content in insecticide-resistant and susceptible mosquitofish, and compares lipid content to survival of susceptible mosquitofish treated with endrin.

14534. Telitchenko, M. M., G. V. Tsytsarin, and Ye. L. Shirokova (Moscow State Univ., Moscow, USSR). 1970. TRACE ELEMENTS AND ALGAL "BLOOM". Hydrobiological Journal, 6(6): 1-6.

It has been established that the algae Aphanizomenon flos-aquae and Microcystis aeruginosa (Cyanophyceae) concentrate 18 trace elements from water, one of which is copper. When copper stocks are exhausted the "bloom" of Cyanophyceae in the body of water ceases. Repeated "blooms" are noted only when the water is enriched with copper by the death of the previous generation of algae. It is therefore concluded that the "bloom" should not be combatted by treatment with copper sulfate.

14535. Balakhnin, I. A., and V. D. Solomatina (Inst. of Hydrobiol., AS UkSSR, Kiev, USSR). 1970. TRANSFERRIN TYPES AND THEIR CONNECTION WITH SOME OF THE EXTERNAL CHARACTERS OF CARP. Hydrobiological Journal, 6(6): 43-48.

Three types of transferrin, A, B and AB, the most prevalent of which are AB and A, have been detected in the blood serum of carp (Cyprinus carpio L.) of Ukrainian brood stock by electrophoresis in starch gel. A correlation, most expressed in males, has been detected between transferrin types, the condition factor and the body length of the fishes. Carp with AB and A transferrin are significantly distinguished by high values of condition factor and body length. In this connection, utilization of the genetic polymorphism of the components of fish blood is probably a promising approach not only for genetic and population research, but also for the practical purposes of fish breeding.

14536. Votintsev, K. K. (Limnol. Inst., Siber. Dept., AS USSR, Listvenichnoye, USSR). 1970. ESTIMATION OF THE GROSS ANNUAL PRIMARY PRODUCTION OF LAKE BAIKAL FROM FIGURES FOR THE OXIDIZABILITY OF THE WATER. Hydrobiological Journal, 6(6): 71-73.

It may readily be domonstrated that the total amount of organic matter synthesized in the course of the year in Baikal, i.e., the gross primary production of phytoplankton (P in g C_{org}) is related to the content of stable organic matter in the lake water (a in g C_{org}) during the period when the oxidizability of the water is lowest by the simple equation: $P = \frac{a \cdot 100}{24.3} = 4.12a.$

The annual gross primary production calculated from the oxidizability of the water varies in the range 79.5-136.0 g C_{org}/m^2 of lake surface. Its mean value for 1950-1960 was found to be 106.6 g C_{org}/m^2 of surface. This figure is very close to that obtained by the flask method during recent years.

14537. Ricker, W. E. (Chief Scientific Specialist of Canada on Fishery Questions). 1971. COMPARISON OF TWO RECRUITMENT CURVES (Sopostavlenie Dvukh Krivykh Vosproizvodstva). Rybnoe Khozyaistvo, No. 3, pp. 16-21. In Russian.

Mathematical comparison is made of the recruitment curve of Ricker, which is characterized by the expressions: $z = we^{\alpha(1-w)}$, and $R = \alpha E e^{-\beta E}$, and the curve of Beverton-Holt: $z = \frac{w}{1 + A(w-1)}$, and $R = \frac{1}{\alpha + \frac{\beta}{E}} = \frac{E}{\alpha E + \beta}$.

14538. Gromov, M. A. 1971. ON CALCULATION OF THE SPECIFIC HEAT OF FISH (O Raschete teploemkosti Ryby). Rybnoe Khozyaistvo, No. 3, pp. 63-64. In Russian.

Two different formulae are given for calculation of the specific heat of fish: $c = wc_1 + ac_2 + bc_3$, and $c = wc_1 + ac_2 + bc_3^{\phi}$. At a temperature of 50°C the value c_3^{ϕ} becomes equal to 0.36 large calories/(kg · degree). In other words formula 2 assumes the appearance of formula 1. At other temperatures, the values of the specific heat of fish can be calculated more accurately by formula 2. -- Robert M. Howland.

14539. Campbell, Homer J. 1971. ECONOMIC AND SOCIAL SIGNIFICANCE OF UPSTREAM AQUATIC RESOURCES ON THE WEST COAST. From Proc. of a Symposium, Forest Land Uses and Stream Environment, Oregon State Univ., Oct. 19-21, 1970, pp. 11-20.

Anadromous fishery resources are almost entirely dependent on upstream watersheds in the Pacific Northwest for their perpetuation. Where data are available known values of spawning areas range from $1,000 to $300,000 per acre annually. Artificial spawning areas built to supplement natural reproduction have an initial cost of $120,000 to $470,000 per acre. Commercial and sport catches of salmon and steelhead exceed 500 million pounds annually on the Pacific Coast. Heavy recreational demand on upstream watersheds is created because urban man needs to return to field, forest, and open water to regain balance. The goal of resource managers should be to communicate and act in ways that maximize human satisfaction from the use of all resources including fisheries, wildlife, and watershed scenery. (Auth.)

14540. Lantz, Richard L. 1971. INFLUENCE OF WATER TEMPERATURE ON FISH SURVIVAL, GROWTH AND BEHAVIOR. From Proc. of a Symposium Forest Land Uses and Stream Environment, Oregon State Univ., Oct. 19-21, 1970, pp. 182-194.

Water temperature can control the functions and activities of freshwater fishes since their body temperature is similar to the temperature of their environment. The removal of streamside vegetation during logging operations can increase water temperatures. Such temperature increases would be most significant on small streams, which are essential to the production of salmon and trout in the Pacific Northwest. A general technical review of the effects of temperature on fish survival, growth, and behavior is presented. Concepts regarding the thermal requirements of fish are summarized. Buffer strips of vegetation along streams are suggested as an important land management tool. In addition to eliminating or minimizing water temperature increases, buffer strips serve other purposes and provide for true multiple-use of the resources of our watersheds. (Auth.)

14541. McCain, B. B., J. L. Fryer, and K. S. Pilcher (Dept. of Microbiol., Oregon State Univ., Corvallis, Oregon). 1971. ANTIGENIC RELATIONSHIPS IN A GROUP OF THREE VIRUSES OF SALMONID FISH BY CROSS NEUTRALIZATION. Reprint from Proc. Soc. Exp. Biol. and Med., 137(3): 1042-1046.

Three viruses of salmonid fish, the Oregon sockeye salmon virus (OSV), the Sacramento River chinook salmon virus (SRCV), and the infectious hematopoietic virus of sockeye salmon and rainbow trout (IHN), have been studied by means of the plaque neutralization technique, with both homologous and heterologous antisera. The OSV and IHN agents were indistinguishable by this method. The SRCV was closely related to the other 2 antigenically, but the results of the cross neutralization assays indicated a significant difference between this virus and the others. (Authors summ.)

14542. Thunberg, Bruce Einar (Grad. School of Oceanog., Univ. of Rhode Island, Kingston, Rhode Island). 1971. OLFACTION IN PARENT STREAM SELECTION BY THE ALEWIFE (Alosa pseudoharengus). Anim. Behav., Vol. 19, Part 2, pp. 217-225.

The ability of the alewife, Alosa pseudoharengus, to discriminate between water from its spawning pond and from neighbouring ponds was studied. Fish were tested in a two choice selection tank with various water combinations. Single fish were placed in the tank and their time spent at each end was recorded. A control period was statistically compared to the test period. The alewives strongly preferred home water. Selection did not occur when the nares were plugged with cotton, but upon removal of the cotton, selection for home water reappeared. Evidence presented here for 'home stream' selection on the basis of odour suggests that alewives may use this mechanism to return to their parent stream. (Auth.)

14543. Olla, Bori L., and Anne L. Studholme (NMFS, Sandy Hook Sport Fish. Mar. Lab., Highlands, New Jersey). 1971. THE EFFECT OF TEMPERATURE ON THE ACTIVITY OF BLUEFISH, Pomatomus saltatrix L. Biol. Bull., 141(2): 337-349.

The swimming speed of the bluefish increased as temperature increased or decreased from acclimation levels of 19-20°C. As the temperature approached 11.9°C and 29.8°C, there were significant changes in average swimming speed and schooling which were considered to be indicative of stress. The daily rhythmic activity was not well-defined at stress temperatures. As the temperature departed from stress levels toward acclimation, swimming speed dropped significantly and the daily rhythm of activity returned. (Authors summ.)

14544. Wallace, Dale C. (Dept. of Biol., Eastern Mich. Univ., Ypsilanti, Michigan). 1971. AGE, GROWTH, YEAR CLASS STRENGTH, AND SURVIVAL RATES OF THE WHITE PERCH, Morone americana (Gmelin) IN THE DELAWARE RIVER IN THE VICINITY OF ARTIFICIAL ISLAND. Chesapeake Science, 12(4): 205-218.

More than 1400 white perch were studied to determine growth, year class strength and survival rates in a section of the Delaware River. Except for young of the year, all specimens were collected with trawl and trap nets. There was no difference in size selection using these two methods. The annulus is a valid year mark. Most individuals had completed the annulus by mid-June. However, the period of annulus completion extended from at least the first week in May to the end of July with older individuals completing the annulus later. In their first year white perch attained approximately 40% of the length attained by the eighth year. Young-of-the-year continue growth through the month of November while older fish grew little after September. Up to their fifth year, females grew somewhat faster than males. Based on the 1960 through 1964 year classes males had higher survival rates than females. In general, growth rates were lower in this section of the river than was previously reported for the Patuxent or Delaware Rivers. For both sexes growth rates were greater in the east side of the river than in the west. This was not due to differences in mean temperatures. The 1964 and 1966 year classes were relatively strong compared with others. The relatively good growth in 1965 probably contributed to a higher number of recruit spawners in 1966. The number of fish older than age group III increased in July and August collections and decreased progressively from September through November. Very few fish older than age group VIII were captured. (Auth.)

14545. Tsai, Chu-fa, and George R. Gibson, Jr. (Nat. Res. Inst., Univ. of Maryland, College Park, Maryland). 1971. FECUNDITY OF THE YELLOW PERCH, Perca flavescens Mitchill, IN THE PATUXENT RIVER, MARYLAND. Chesapeake Science, 12(4): 270-284.

The fecundity of 114 female yellow perch was studied during the 1969 spawning run (20 through 25 March) in the Patuxent River, Maryland. The fecundity was proportional to the total weight and gutted weight respectively as expressed by the regression equations $Y = 150.55730\ X - 1,424.0878$ ($r = 0.88$) for the former, and $Y = 217.67656\ X - 2,387.9915$ ($r = 0.87$) for the latter, (Y, fecundity, X, either total weight or gutted weight). It was nearly proportional to the quadruplicate of fork length as expressed by the regression equation, $\log Y = 3.7179 \log X - 1.50917$ ($r = 0.90$). This quadruplicate phenomenon was due in part to the heavier proportionate increase in body weight and the visceral space available for egg development as the fish length increased. (Authors)

14546. Tsai, Chu-fa (Nat. Res. Inst., Univ. of Maryland, College Park, Maryland). 1971. OCCURRENCE OF THE FATHEAD MINNOW, Pimephales promelas (PISCES: CYPRINIDAE), IN THE CHESAPEAKE ATLANTIC SLOPE DRAINAGES. Chesapeake Science, 12(4): 274-275.

In a 1970 fish survey in Maryland, Northern Virginia, and eastern Pennsylvania, the fathead minnow was found in the Piedmont region of the Susquehanna and Potomac River drainages in Pennsylvania and Maryland, respectively. A total of 15 fish was collected from five localities. These specimens represent an extension of the eastern range.

14547. Kroger, Richard L., and James F. Guthrie (NMFS, Center for Estuarine and Menhaden Research, Beaufort, North Carolina). 1971. INCIDENCE OF CROOKED VERTEBRAL COLUMNS IN JUVENILE ATLANTIC MENHADEN, Brevoortia tyrannus. Chesapeake Science, 12(4): 276-278.

Juvenile Atlantic menhaden from 20 estuaries between Florida and Massachusetts were visually examined for crooked vertebral columns. Only 12 abnormal juveniles were collected and all came from two streams in Massachusetts. Radiographs showed kyphosis, lordosis, scoliosis and fusion of the vertebral columns. These and previous observations suggest that crooked backbones may be endemic only to menhaden spawned in the extreme northern regions of their range. This is the first reported incidence in menhaden of scoliosis and of kyphosis and lordosis of the caudal vertebrae. (Authors)

14548. Wetzel, Robert G. 1969. FACTORS INFLUENCING PHOTOSYNTHESIS AND EXCRETION OF DISSOLVED ORGANIC MATTER BY AQUATIC MACROPHYTES IN HARD-WATER LAKES. Verh. Internat. Verein. Limnol., Vol. 17, pp. 72-85.

The investigations were carried out on submerged water plants in axenic culture. Factors were determined which control low photosynthesis activity and the excretion of dissolved organic substances. The photosynthesis activity was measured as carbon - fixation activity through wet combustion of the plant tissue followed by measurement of the radioactivity of the resulting $^{14}CO_2$ in the gas phase. The excretion of dissolved organic compounds by the water plants was determined by conversion of the organic compounds into CO_2 followed by infra-red CO_2 analysis as well as by measurement of $^{14}CO_2$ radioactivity. The experimental findings relative to photosynthetic growth and excretions are brought into relationship to the following factors: 1. to different concentrations of calcium, magnesium, sodium, or potassium; to the influence of cation proportions and to relative concentration factors; 2. to other, inorganic compounds; 3. to existing carbon sources; 4. to organic growth substances; 5. to the light intensity and 6. to erroneous determinations, as they can occur in the in situ ^{14}C-method for water plants. These growth findings in respect to water plants are discussed in connection with observed location conditions and experimental results concerning the phytoplankton of marl lakes. A scheme is offered in which such causative relations are presented which contribute to the regulation of photosynthesis. -- Robert M. Howland

14549. Coppage, David L. (Gulf Breeze Lab., Pesticides Office, Environ. Proteaction Agency, Gulf Breeze, Florida). 1971. CHARACTERIZATION OF FISH BRAIN ACETYLCHOLINESTERASE WITH AN AUTOMATED pH STAT FOR INHIBITION STUDIES. Bull. of Environmental Contamination and Toxicology, 6(4): 304-310.

This report concerns characterization of brain ACLE of sheepshead minnows, Cyprinodon variegatus, by means of an automated pH stat for use in inhibition studies. The function of enzyme and choline ester concentration, the action of enzyme on specific choline esters, and the effects of pH and temperature on ACLE activity were studied to determine suitable assay conditions for brain ACLE. Also, the effects of several inhibitors were studied in vitro and compared with toxicity. A method for in vivo inhibition studies is proposed.

14550. Young, Roger G., Leigh St. John, and D. J. Lisk (Dept. of Entomol., N. Y. State Coll. of Agric., Cornell Univ., Ithaca, New York). 1971. DEGRADATION OF DDT BY GOLDFISH. Bull. of Environmental Contamination and Toxicology, 6(4): 351-354.

Goldfish were fed DDT for three weeks, then exposed to phenobarbital solution for one week to study the possibility of microsomal enzyme induction and therefore possibly enhanced insecticide excretion. Analysis of DDT, DDE and DDD were made at intervals up to six weeks. Forty percent of the DDT fed was incorporated during the feeding. It was recovered mainly as DDE (68 to 96%). Significant differences between pesticide levels of phenobarbital treated and control fish were not found. (Authors summ.)

14551. Rafail, S. Z. (Inst. of Oceanog. and Fish.; Kayed Bey, Alexandria, Egypt). 1971. ESTIMATION OF ABUNDANCE OF FISH POPULATIONS BY CAPTURE-RECAPTURE EXPERIMENTS. Marine Biology, 10(1): 1-7.

A natural fish population is assumed to be subjected to a number of fishing experiments, during which the captured fish are released after tagging all untagged fish. Assuming that, in the k^{th} sampling survey, the tagged and untagged fish are subjected to P_{tk} and P_{uk} fishing rates, and S_{tk} and S_{uk} survival rates, respectively, the population size can be estimated from an estimate of P_{uk}

i.e., $1 - P_{uk} = P_{tk} \cdot \frac{S_t(k+1)}{S_u(k+1)}$

$\frac{\text{Number of fish captured for the first time in the } (k+1)^{th} \text{ survey plus fish belonging to this group captured later}}{\text{Number of fish captured for the first time in the } k^{th} \text{ and captured again in the } (k+1)^{th} \text{ experiment plus fish belonging to this group which are captured later}}$

All terms of the right hand side of the above equation are provided by capture-recapture experiments, except the survival rate of untagged fish which may be obtained by other information. This estimate of fishing rate of untagged fish is free from type (A) errors. (Auth.)

14552. Cutkomp, L. K., H. H. Yap, E. Y. Cheng, and R. B. Koch (Dept. of Entom., Fish. and Wildl., Univ. of Minn., St. Paul, Minnesota). 1971. ATPase ACTIVITY IN FISH TISSUE HOMOGENATES AND INHIBITORY EFFECTS OF DDT AND RELATED COMPOUNDS. Chem.-Biol. Interactions, 3(6): 439-447.

The specific activities of ATPases in homogenates of bluegill fish tissues were determined and found to be similar to those previously reported for rabbit tissues. Na^+-K^+ ATPase was most active in brain and kidney, and Mg^{2+} ATPase was most active in muscle. A prominent inhibition of Mg^{2+} ATPase by DDT and TDE tested in vitro was found in tissue homogenates of fish muscle; inhibition was also found in brain, kidney and liver. Less effective, when compared at low concentrations, were DDE, o,p'-DDT and dicofol. DDA was inactive and methoxychlor had little effect. Dicofol was the only closely related compound which had a greater effect on Na^+-K^+ ATPase of the brain than on Mg^{2+} ATPase. A synergistic effect resulted when DDT and dicofol were combined, producing greater inhibition of muscle ATPases. Selected chlorinated hydrocarbons of the cyclodiene group also showed inhibitory effects, with Na^+-K^+ ATPase inhibition being almost equal to Mg^{2+} ATPase inhibition. Epoxides of the selected cyclodienes were less effective inhibitors of the enzyme system. The significance of these findings are discussed in relation to enzyme inhibition and toxicity of DDT and other compounds. (Authors summ.)

14553. Umminger, Bruce L. (Dept. of Biol. Sci., Univ. of Cincinnati, Cincinnati, Ohio). 1971. OSMOREGULATORY OVERCOMPENSATION IN THE GOLDFISH, Carassius auratus, AT TEMPERATURES NEAR FREEZING. Copeia, No. 4, pp. 686-691.

The serum chemistry of the goldfish, Carassius auratus, was examined at 20°, 10°, and 0.5°C. Acclimation to temperatures near freezing was characterized by a decrease in serum electrolytes (sodium, chloride, and potassium), an increase in serum osmolality, and an increase in serum glucose. An increase in the serum osmolality of a freshwater fish in the cold despite reductions in the concentrations of serum electrolytes has been termed osmoregulatory "overcompensation." The goldfish is the first fish in which this pattern of osmoregulation has been reported. The increase in serum osmolality in the cold was not the result of the increase in serum glucose (which was osmotically insignificant), but was due to a buildup of yet unidentified, probably organic, constituents of the serum. (Auth.)

14554. Arita, George S. (Dept. of Biol. Sci., Univ. of Calif., Santa Barbara, California). 1971. A RE-EXAMINATION OF THE FUNCTIONAL MORPHOLOGY OF THE SOFT-RAYS IN TELEOSTS. Copeia, No. 4, pp. 691-697.

The soft-rays in the fins of teleostean fishes are structurally complex; they consist of bilateral halves (hemitrichia), which are segmented and often branched.

Two types of movement have been attributed to the soft-ray: one in the longitudinal plane and the other in the lateral plane, with the entire ray moving as a unit. But this classical description does not adequately account for the complex structural features of soft-rays. Examination of live and preserved specimens of 54 species suggests a third type of movement in the vertical plane, with each hemitrich moving more or less independently of the other. This bends the soft-ray either to the right or left, depending on which hemitrich is being pulled down. This bending action stiffens the soft-ray and helps to counteract the hydrodynamic force which tends to bend the ray in the opposite direction. This third type of movement was observed in the soft-rays of preserved specimens by pulling lightly on the bases of the rays of the different fins. The bending was also demonstrated experimentally in the dorsal fin of live goldfish by tilting the fish to its left through various arcs and by electrically stimulating the muscles controlling each soft-ray. (Auth.)

14555. Piavis, George W., and James L. Hiatt (Dept. of Anat., School of Dentistry, Univ. of Maryland, Baltimore, Maryland). 1971. BLOOD CELL LINEAGE IN THE SEA LAMPREY, Petromyzon marinus (PISCES: PETROMYZONTIDAE). Copeia, No. 4, pp. 722-728.

Blood cell types of the sea lamprey, Petromyzon marinus, are described and identified and the lineage of mature circulating cells in peripheral blood is traced to blast cells in the hematopoietic fat body. The fat body appears to be the phylogenetic precursor of bone marrow in higher forms, since blood cells originate and begin maturation in this tissue. Experimental animals were injected first with a hematopoietic stimulant and then (at an experimentally determined time) with pertussis vaccine to release proliferated blood cells into peripheral blood. Peripheral blood for smears was collected by cardian exsanguination; hematopoietic tissue was extirpated for imprints; and leucocyte preparations were made by a special technique. Blood cells of the sea lamprey are apparently products of at least four distinct blast cells, each of which has a "one end" maturation process. Results of this investigation support the polyphyletic theory of blood cell formation. (Authors)

14556. Bearden, Charles M. (So. Carolina Wildl. Res. Dept., Mar. Resources Div., Charleston, South Carolina). 1971. OCCURRENCE OF JUVENILE BROAD FLOUNDER, Paralichthys squamilentus, IN SOUTH CAROLINA COASTAL WATERS. Copeia, No. 4, pp. 729-730.

During May and June of 1969, juvenile specimens (60) of P. squamilentus were collected in shallow water (0.3-1.3 m) along the open ocean beaches of South Carolina by a 22 m, 6 mm (square mesh) seine. There are several potential explanations for the rather unusual occurrence of juvenile broad flounders along South Carolina beaches. One possibility is that 1969 was a year of exceptionally high spawning success for the species. Another possible explanation is that the young of P. squamilentus have been overlooked in the past or confused with juveniles of related species of Paralichthys occurring in the same areas.

14557. Hallowitz, Robert A., Donald J. Woodward, and Leo S. Demski (Depts. of Physiol. and Anat., Univ. of Rochester, Rochester, New York). 1971. FOREBRAIN ACTIVATION OF SINGLE UNITS IN PREOPTIC AREA OF SUNFISH. Comp. Biochem. Physiol., 40(3A): 733-741.

Single unit activity from presumed parvocellular elements in the preoptic area of sunfish in response to stimulation of a variety of forebrain areas at low frequencies, less than 5/sec, showed an augmentation from a single spike to three or four over a 3- to 4-min interval. Correlations were drawn between neural responses to low frequency stimulation and a specific "nestbuilding" behavioral response found in previous studies. The pattern of forebrain input to single cells is consistent with the hypothesis that both general facilitation and specific activation of components of motivated behavior are functions of the forebrain. (Authors)

14558. McNabb, Roger A., and John A. Mecham (Dept. of Biol., Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1971. THE EFFECTS OF DIFFERENT ACCLIMATION TEMPERATURES ON GAS SECRETION IN THE SWIMBLADDER OF THE BLUEGILL SUNFISH, Lepomis macrochirus. Comp. Biochem. Physiol., 40(3A): 609-616.

After acclimation to 12, 22 or 32°C, the swimbladders of bluegill sunfish (Lepomis macrochirus) were partially deflated. Rates of gas secretion into the bladder were measured. Total gas secretion, measured as the rate of reinflation, was temperature independent. The rates of oxygen secretion into the swimbladder increased with increasing acclimation temperature; simultaneously, the rate of carbon dioxide secretion decreased. (Authors)

14559. Cameron, James N. (Univ. of Br. Columbia, Dept. of Zool., Vancouver, British Columbia, Canada). 1971. METHEMOGLOBIN IN ERYTHROCYTES OF RAINBOW TROUT. Comp. Biochem. Physiol., 40(3A): 743-749.

The proportion of hemoglobin carried as oxidized (met-) hemoglobin was found to vary from 2.9 percent in a wild stock to 17 percent in a hatchery stock of rainbow trout. Hypoxia, anemia and the reticulocyte percentage (and consequently cell age) had little effect on the methemoglobin content. Nitrates and nitrites in water had no significant long-term effect, but intravenous ascorbic acid tends to reduce methemoglobin. The experiments revealed that little or no erythrocyte synthesis takes place in response to hypoxia. (Auth.)

14560. Bass, Eugene L. (Dept. of Zool., Univ. of Mass., Amherst, Massachusetts). 1971. TEMPERATURE ACCLIMATION IN THE NERVOUS SYSTEM OF THE BROWN BULLHEAD (Ictalurus nebulosus). Comp. Biochem. Physiol., 40(3A): 833-849.

The gustatory response of the brown bullhead (Ictalurus nebulosus) was used as an indicator system for assessing the nature and location of temperature acclimation in the nervous system. Complete acclimation was found to occur in the brains of cold-acclimated but not warm-acclimated animals. No acclimatory response was found in either the peripheral sensory nerves or the spinal portion of the reflex pathway. Data presented in this study support the theory that the synapse is the primary locus of acclimatory responses although the actual mechanism of compensation remains unknown. (Auth.)

14561. Sage, Martin (Univ. of Texas, Mar. Sci. Inst., Port Aransas, Texas). 1971. RESPIRATORY RESPONSE OF THE TELEOST Poecilia reticulata TO RISING TEMPERATURE. Comp. Biochem. Physiol., 40(3A): 851-853.

The respiratory rate of Poecilia reticulata was measured while the temperature increased from 25 to 30°C at a rate of 0.25°C/min. There was a rapid initial increase in oxygen consumption that stopped when the temperature rise was completed. This was followed by a level of oxygen uptake that was higher than the initial rate and had a Q_{10} of 1.7. The rapidity of the responses indicates nervous mediation and/or a direct effect of temperature on individual cells rather than an endocrine control. (Auth.)

14562. Kitchin, S. E., and D. Morris (Dept. of Physiol. and Biochem., The Univ. of Southampton, Southampton SO9 5NH, Hampshire, England). 1971. THE EFFECT OF ACCLIMATION TEMPERATURE ON AMINO ACID TRANSPORT IN THE GOLDFISH INTESTINE. Comp. Biochem. Physiol., 40(2A): 431-443.

The intestinal transport of methionine and valine has been studied in vitro using goldfish acclimated to 8, 15 and 25°C. The rate of uptake of valine increased at low acclimation temperatures; this was associated with an increased affinity of the amino acid for the transport mechanism. It is suggested that at low temperatures both the number and the turnover rate of the carrier molecules for valine increases. For methionine, the rate of uptake decreased at low acclimation temperatures; the affinity for the transport mechanism was temperature independent. The inhibition of uptake of one amino acid in the presence of the other is probably competitive. (Authors)

14563. Edwards, R. R. C. (Marine Lab., Aberdeen, Scotland). 1971. AN ASSESSMENT OF THE ENERGY COST OF GILL VENTILATION IN THE PLAICE (Pleuronectes platessa L.). Comp. Biochem. Physiol., 40(2A): 391-398.

An even rate of oxygen consumption was induced in plaice by immersion in MS 222 (Sandoz) at a concentration of 25 mg/l. of sea water. A subcutaneous injection of 0.1-0.3 ml lignocaine hydrochloride B.P. (20 mg/l.) caused an increase in the rate of oxygen consumption and ventilation volume. Gill paralysis was induced by the injection of lignocaine hydrochloride (20 mg/l.) adjacent to the vagus nerve. A subsequent decline in the rate of oxygen consumption of 28.76 and 22.27 percent at 10 and 15°C respectively was measured. (Auth.)

14564. Suzuki, Noriyo, and Don Tucker (Dept. of Biol. Sci., Fla. State Univ., Tallahassee, Florida). 1971. AMINO ACIDS AS OLFACTORY STIMULI IN FRESHWATER CATFISH, Ictalurus catus (Linn.). Comp. Biochem. Physiol., 40(2A): 399-404.

Olfactory receptors of the white catfish Ictalurus catus (Linn.) are extremely sensitive to the simple amino acids. The six most effective of twenty-three tested on the receptors are L-glutamine>L-methionine>L-alanine>L-asparagine>D-methionine>L-cysteine. The lowest estimated threshold concentration range was between 10^{-7} and 10^{-8} M. The L-isomer of an amino acid was always more effective than its D-isomer. Amino acids or peptides appear to play an important role in fish olfactory behavior. (Authors)

14565. Owen, T. G., and A. J. Wiggs (Dept. of Biol., Univ. of New Brunswick, Fredericton, New Brunswick, Canada). 1971. THERMAL COMPENSATION IN THE STOMACH OF THE BROOK TROUT (Salvelinus fontinalis Mitchill). Comp. Biochem. Physiol., 40(2B): 465-473.

Thermal compensation was studied in the stomach of the brook trout (Salvelinus fontinalis Mitchill) by determining if differences in pepsin occurred as a result of acclimation to 5 and 12°C. No qualitative differences were indicated by pH or R-T curves. Quantitative differences did occur. Extracts of gastric mucosa from 5°C trout exhibited 30 percent greater activity than those from 12°C trout. Certain temperature-dependent changes in the enzyme are discussed in relation to multiple forms of pepsinogen. (Authors)

14566. Nyman, O. L., and Derek H. Shaw (Fish. Res. Bd. of Canada, P. O. Box 5653, St. John's, Newfoundland, Canada). 1971. MOLECULAR WEIGHT HETEROGENEITY OF SERUM ESTERASES IN FOUR SPECIES OF SALMONID FISH. Comp. Biochem. Physiol., 40(2B): 563-566.

Molecular weights of the monomorphic serum esterases of brook trout, brown trout and Atlantic salmon were found to be 53,200, 52,100 and 54,200 respectively. A similar molecular weight of 54,200 was found for the Est^F allele in arctic char, whereas the alternative allele in this species had a molecular weight of 89,200. Some biological implications of the findings are discussed. (Authors)

14567. Davis, Paul W., and Gary A. Wedemeyer (Dept. of Pharmacology, Univ. of Wash. School of Med. and Western Fish Disease Lab., Dept. of Interior, Seattle, Washington). 1971. Na^+, K^+-ACTIVATED-ATPase INHIBITION IN RAINBOW TROUT: A SITE FOR ORGANOCHLORINE PESTICIDE TOXICITY? Comp. Biochem. Physiol., 40(3B): 823-827.

The Na^+, K^+-activated, Mg^{2+}-dependent-ATPase enzyme system in a heavy microsomal fraction of rainbow trout (Salmo gairdneri) brain was inhibited in vitro by chlorinated hydrocarbon pesticides. I_{50} (concentration at 50 percent inhibition) values for dicofol, endosulfan and DDT were 5×10^{-6}, 3×10^{-5} and 1×10^{-4} M respectively. Similar inhibition by these pesticides occurred in kidney and gill ATPase preparations. An unexpected finding was a failure of the classic inhibitor, ouabain, to block the Na^+, K^+-activated component of ATPase activity in the gill. It is suggested that inhibition of ATPase activity may be a causal factor in the toxic effects of organochlorine pesticides in fishes. (Authors)

14568. Rafail, S. Z. (Inst. of Oceanog. and Fish., Kayed Bey, Alexandria, Egypt (UAR). 1971. ESTIMATION OF SOME PARAMETERS OF LARGE FISH POPULATIONS BY CAPTURE-RECAPTURE EXPERIMENTS. Marine Biology, 10(1): 8-12.

A certain number of tagged fish is liberated and assumed to be distributed randomly among a natural fish population. The fish are subjected to a number of fishing experiments within relatively short periods, and lie between equal intervening periods of duration T. Untagged fish are retained, while tagged fish are released during the fishing experiments. Denoting the catchability of untagged fish by q_u and that for tagged fish by q_t, it is assumed that they are related by the equation "$q_u = cq_t$" where c is a constant. Denoting the survival rates of tagged fish and the effective fishing effort of commercial fisheries per unit time from the $(k-1)^{th}$ to the k^{th} experiments by ${}_tS_k$ and f_k, respectively, it is assumed that they vary from period to period. Assuming that during the k^{th} experiment, the number of untagged fish captured and the experimental fishing rate of tagged fish are denoted by ${}_uX_k$ and ${}_tP_k$, respectively, then

$$\frac{(uXk)^2}{[uX(k-1)]\,[uX(k+1)]} = \frac{tS_k}{tS_{(k+1)}} \cdot \frac{e^{-(1-c)q_t f_{(k+1)}T}}{e^{-(1-c)q_t f_k T}} \cdot \frac{1 - c\,{}_tP_{(k-1)}}{1 - c\,{}_tP_k} \cdot \frac{({}_tP_k)^2}{[{}_tP_{(k-1)}]\,[{}_tP_{(k+1)}]}.$$

The above equation contains c as a single unknown, while all other terms are supplied by the capture-recapture experiments, except f_k and $f_{(k+1)}$ which may be obtained from fisheries statistics. A number of the above equations are obtained from several experiments and can be combined into a single equation to obtain an overall estimate for c which can be used to derive estimates for experimental fishing rates, abundance, and instantaneous natural and fishing mortality rates for natural fish populations. These estimates are free from type (A) tagging errors, and have the advantage of taking into consideration the probable different behaviour of tagged and untagged fish. (Auth.)

14569. Cvancara, Victor A. (Dept. of Biol., Wis. State Univ., Eau Claire, Wisconsin). 1971. LIVER ARGINASE ACTIVITY IN THE SOCKEYE SALMON, Oncorhynchus nerka. Comp. Biochem. Physiol., 40(3B): 819-822.

Liver arginase levels in adult sockeye salmon show characteristics similar to that of higher animals. Results show that sockeye liver arginase has a pH optimum of 9.5, is partially dependent on Mn^{2+} ions and has a temperature optimum of 45°C. (Auth.)

14570. Cannon, L. R. G. (Depts. of Parasitology and Zoology, Univ. of Toronto, Toronto, Ontario, Canada). 1971. THE LIFE CYCLES OF Bunodera sacculata AND B. luciopercae (TREMATODA: ALLOCREADIIDAE) IN ALGONQUIN PARK, ONTARIO. Canad. J. Zool., 49(11): 1417-1429.

Miracidia of Bunodera sacculata and Bunodera luciopercae develop into sporocysts in the gills of Pisidium variabile, where rediae are first produced after 60 to 70 days at 20C. Each redia has a well-developed pharynx, but neither gut nor lateral processes. Mature rediae, each with a birth pore and a degenerate pharynx, occur near the clam's gonad and contain ophthalmoxiphidiocercariae with a flame cell formula 2[(3+3+3) + (3+3+3)]. Cercarial stylets of B. sacculata and B. luciopercae are 15 and 18 long respectively. Only cercariae of B. sacculata have cystogenous glands. Infective metacercariae of B. sacculata develop in Daphnia similis and Moina affinis within 6 days and have well-developed reproductive structures unlike those of B. luciopercae, which develop within 12 days in Hyalella azteca and Crangonyx gracilis. Juvenile B. sacculata retain dark granules in the excretory bladder until they mature, which is within 3 weeks in the intestine of Perca flavescens. B. luciopercae juveniles, which expel the contents of the excretory bladder when they excyst, mature slowly, gradually moving from the gall bladder, where they first establish, to the intestine, where the first eggs are produced after 5 or 6 months. In B. sacculata spermatogenesis is abortive and reproduction parthenogenetic. (Auth.)

14571. Cowan, Garry I. McT. (Marine Sci. Res. Lab. and Dept. of Biol., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1971. COMPARATIVE MORPHOLOGY OF THE COTTID GENUS Myoxocephalus BASED ON MERISTIC, MORPHOMETRIC, AND OTHER ANATOMICAL CHARACTERS. Canad. J. Zool., 49(11): 1479-1496.

Specimens representing 15 nominal species of the genus Myoxocephalus were subjected to detailed comparative morphological study to determine some of the more important species characteristics and also those indicating potential for expressing phylogenetic progression. Analysis of seven meristic characters revealed that none of them is consistently sexually dependent. Geographic variation within the species indicated the presence of both latitudinal and longitudinal clines. No evolutionary group affinities were evident. The morphology of the cephalic lateral line system, lateral line ossicles, squamation, and olfactory rosettes were found to exhibit a high degree of specificity, especially the first three systems. With the exception of the lateral line ossicles all evidenced some potential as indicators of phylogeny. Analysis of 23 morphometric characters was accomplished by cluster analysis. The resultant clusters indicated heterogenous unnatural groupings. On the basis of these analyses well-defined species differences exist in most of the major morphological features. The nominal species M. scorpius (Linnaeus) includes three distinct species (Gulf of Alaska, Arctic - East coast, and European). In addition, the data indicate that the genus is probably composed of three basic evolutionary lines: the Holarctic-Atlantic, Bering Sea-Transpecific, and Asiatic. (Auth.)

14572. Butler, Jerry A., and Raymond E. Millemann (Dept. of Fish. and Wildl., Mar. Sci. Center, Oregon State Univ., Newport, Oregon). 1971. EFFECT OF THE "SALMON POISONING" TREMATODE, Nanophyetus salmincola ON THE SWIMMING ABILITY OF JUVENILE SALMONID FISHES. J. Parasit., 57(4): 860-865.

Coho salmon, Oncorhynchus kisutch, and steelhead trout, Salmo gairdneri, 57 to 60 mm in total length, were exposed either once for 1 hr to 1,500 cercariae of Nanophyetus salmincola, or daily for 1 hr to 100 of these parasites for 15 days. The effect of the parasites on the swimming ability of fish exposed only once was determined immediately after exposure, or after 6, 12, 24, or 96 hr, or after 15 days; fish exposed daily were tested immediately after the last exposure. Groups of control and infected fish were tested together in a swimming tube. In some tests, the water velocity in the tube was increased gradually at 10-min intervals, and the velocity at which each fish became fatigued was recorded. In other tests, the water velocity was suddenly increased to a high, constant level, and the duration of swimming of each fish at that velocity was recorded. In both types of tests, there was a marked effect of the parasite on the swimming ability of fish exposed once and tested 0 to 96 hr later and on those exposed repeatedly and tested after their last exposure. The mean swimming speeds or times of groups of steelhead trout were reduced by 10 to 58%, as compared with those of controls, and corresponding percent reduction values for coho salmon ranged from 4 to 95%. This impairment of the swimming ability of infected fish is attributed to tissue injury caused by migrating parasites. The swimming ability of fish that were exposed once and tested 15 days later, when the parasites were encysted, was little affected. However, it is likely that the effect would have been greater had the infections been heavier. (Authors)

14573. Dukes, George H., Jr., Robert M. Shealy and Wilmer A. Rogers (Dept. of Biol. Sci., McNeese St. Coll., Lake Charles, Louisiana). 1971. Sebekia oxycephala (PENTASTOMIDA) IN LARGEMOUTH BASS FROM LAKE ST. JOHN, CONCORDIA PARISH, LOUISIANA. J. Parasit., 57(5): p. 1028.

Immature stages of the pentastomid, Sebekia oxycephala (Diesing) Sambon, 1922, were recovered from 23 of 34 largemouth bass from Lake St. John, Concordia Parish, Louisiana. This is the first report of this parasite from largemouth bass, Micropterus salmoides (Lacépède). (Authors)

14574. Surber, Eugene W. (Res. Biologist, Va. Comm. of Game and Inland Fish, Brownton, Virginia). 1971. THE EFFECT OF OUTBOARD MOTOR EXHAUST WASTES ON FISH AND THEIR ENVIRONMENT. J. Wash. Acad. Sci., 61(2): 120-123.

Bluegill sunfish were placed in liveboxes and sampled at two-week intervals in (1) a lake where much water skiing occurred, (2) in a pond where outboard motors with low-pitched propellors were operated by project personnel, and (3) in a control pond where outboard motors were not operated. The fish were fried in vegetable oil and cracker meal at a temperature of 370°F (188°C) or baked in aluminum foil before being tasted by a taste panel of 12 members. The tainting of fish occurred at a level of about 2.6 gal outboard motor fuel/acre-ft of water or 8 gal fuel/million gal water (0.055 gal/acre ft). Threshold odor, carbon chloroform extractables, and chlorine demand showed significant increases in the motor lake and motor pond through the season of outboard motor operation. All water samples from the motor lake and motor pond contained less than 10 μg/l of lead determined by polarograph. (Auth.)

14575. Aronson, Arthur L. (Dept. of Physiol., Biochem. and Pharmacol., N. Y. State Vet. Coll., Cornell Univ., Ithaca, New York). BIOLOGIC EFFECTS OF LEAD IN FISH. J. Wash. Acad. Sci., 61(2): 124-128.

There is no evidence that lead constitutes a health problem to fish in the United States. But there is very little evidence on which to base any firm conclusion. Very few analytic data have been reported on concentrations of lead in fish in natural or experimental conditions. What data are available suggest that soluble lead is not present in natural waters of the United States in concentrations likely to be toxic to fish. There is no published evidence of any trend toward increased concentrations of soluble lead in natural waters. Much of the man-dispersed lead that is eventually washed into natural waters is probably precipitated owing to the presence of carbonates, hydroxides, and organic ligands in the water and settles to the bottom. There is no evidence that lead precipitated on the bottom of natural waterways is harmful to fish. (Auth.)

14576. Shafi, Muhammed, and Peter S. Maitland (Dept. of Zool., Univ. of Glasgow, Glasgow, Scotland). 1971. COMPARATIVE ASPECTS OF THE BIOLOGY OF PIKE, Esox lucius L., IN TWO SCOTTISH LOCHS. Proc. Roy. Soc. Edinb. (B) Biology, 71(1): 41-60.

Several aspects of the biology of pike (Esox lucius L.) in two contrasting waters in Scotland were studied: one of these, Loch Lomond, is large and mesotrophic while the other, the Dubh Lochan, is small and dystrophic. Altogether, over 300 fish were examined during the study. Formulae for the length-weight relationship of pike in both waters were established. Age and growth was studied using opercular bones; the pattern of growth was found to be the same throughout life, females growing faster than males in both lochs. The growth was found to follow Von Bertalanffy's formula closely and growth formulae for fish in both waters were established. The fecundity of pike in Loch Lomond indicated an average of 29,300 eggs per kilogram of body weight although the relationship was not a close one. The food of pike in the Dubh Lochan consisted mainly of perch (Perca fluviatilis L.) and invertebrates, and in Loch Lomond of powan (Coregonus clupeoides Lacépède) and trout (Salmo trutta L.). Tagging experiments in the Dubh Lochan indicated that the size of the population there was small - estimated at 89 adult fish in 1967 and 51 in 1968. (Authors synopsis)

14577. McKone, Colin E., Roger G. Young, Carl A. Bache, and Donald J. Lisk (Dept. of Entomol., Cornell Univ., Ithaca, New York). 1971. RAPID UPTAKE OF MERCURIC ION BY GOLDFISH. Environmental Science & Technology, 5(11): 1138-1139.

Mercuric ion has been shown to be rapidly absorbed from water by goldfish. The extent of absorption is dependent on mercury concentration and time of exposure. As has been previously shown with other metals, mercury was found to concentrate initially in the external mucus secreted by the fish. The presence of mercury in water appeared to stimulate this secretion. (Authors)

14578. Walsh, Gerald E., Charles W. Miller, and P. T. Heitmuller (EPA, Gulf Breeze Lab., Gulf Breeze, Florida). 1971. UPTAKE AND EFFECTS OF DICHLOBENIL IN A SMALL POND. Bull. of Environmental Contamination and Toxicology, 6(3): 279-288.

Dichlobenil, when applied as a wettable powder at a concentration of one p.p.m. eliminated all P. pectinatus and about 80% of the Chara from a small pond. As benthic plants died, blooms of phytoplankton and zooplankton occurred, presumably because nutrients were released from dead and dying plants. No change was observed in water chemistry at any time during the period of herbicide effect. The normal oxygen regime was maintained by phytoplankton in the bloom condition. As benthic plants returned, numbers of plankters dropped sharply, and the pond returned to the pretreatment state approximately three months after treatment. (Authors summ.)

14579. Vanderpuye, C. J., and K. D. Carlander (Fish. Dept., Akosombo, Ghana, Africa). 1971. AGE, GROWTH AND CONDITION OF BLACK CRAPPIE, Pomoxis nigromaculatus (LeSueur), IN LEWIS AND CLARK LAKE, SOUTH DAKOTA, 1954 TO 1967. Iowa State Journal of Science, 45(4): 541-555.

An abundant year class of black crappies developed in 1956, the year after Lewis and Clark Lake was impounded. No difference in growth rate of male and female crappies was noted. Growth was slow compared with most other waters and was slower the first few years than the 8 to 10 years after impoundment. No differences were detected in length-weight relationships between samples collected in different areas of the lake nor between sexes. The slope of the length weight relationship was more often above 3.0 than below. Slopes were below 3.0 in each June sample, probably because of loss of weight in spawning by the larger individuals. The slopes did not increase in July and August in 1960, 1961 and 1967 as they did in the other years. Average condition factors were lower in 1957, 1959, and 1960. (Authors)

14580. Laser, K. D., and K. D. Carlander (Dept. of Zool. and Entomol., Iowa State Univ., Ames, Iowa). 1971. LIFE HISTORY OF RED SHINERS, Notropis lutrensis, IN THE SKUNK RIVER, CENTRAL IOWA. Iowa State Journal of Science, 45(4): 557-562.

Red shiners were the most abundant fish in this sand-bottom stream. At high water, vegetation became a greater part of the food. Male shiners were territorial at breeding time. Females had 485-684 eggs, in 3 sizes, suggesting intermittent spawning. Few shiners reach age II, most spawning and dying at age I. Difficulties in analyzing length-weight relationship of small fish are discussed. (Authors)

14581. Rehwoldt, Robert, Gerald Bida, and Brian Nerrie (Dept. of Chem., Marist College, Poughkeepsie, New York). 1971. ACUTE TOXICITY OF COPPER, NICKEL AND ZINC IONS TO SOME HUDSON RIVER FISH SPECIES. Bull. of Environmental Contamination and Toxicology, 6(5): 445-448.

The effect of some common industrial inputs upon the life expectancy of Hudson River fishes was investigated by means of bioassays. Copper was the most toxic to all species. The range of concentration for 24 hours was 1.5 ppm for the banded killifish to 11.6 ppm for the white perch. Nickel was the least toxic metal for all species except the American eel. Zinc is more toxic than nickel and for the striped bass the toxicity is almost the same as that for nickel.

14582. Zitko, V. (Fish. Res. Bd. of Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1971. POLYCHLORINATED BIPHENYLS AND ORGANOCHLORINE PESTICIDES IN SOME FRESHWATER AND MARINE FISHES. Bull. of Environmental Contamination and Toxicology, 6(5): 464-470.

Polychlorinated biphenyls (PCB) were found in higher concentrations than organochlorine pesticides in all fish analyzed. Concentrations of PCB in herring (Clupea harengus), salmon (Salmo salar), and mussel (Mytilus edulis) were higher than those reported for the same species from Swedish coastal waters. Concentrations of PCB in cod (Gadus morhua) were approximately the same in both cases.

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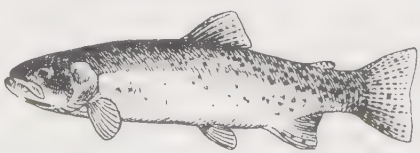

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